THE ALEXANDER-DEWEY ARITHMETIC

ADVANCED BOOK

E. T.

ETHEL H. THURSTON

Harvard
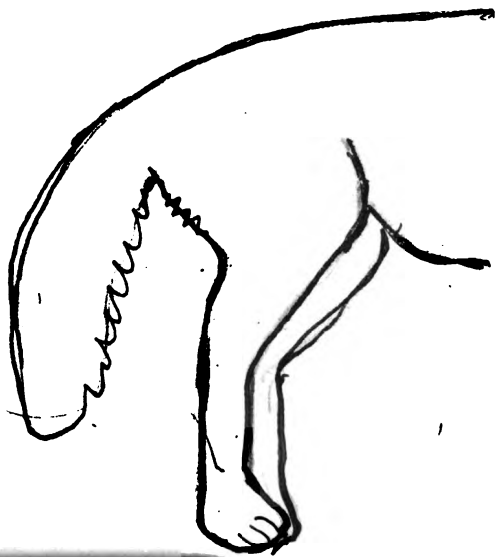
$$\text{I} \quad B \times R = P$$

$$\text{II} \quad P \div R = B$$

$$\text{III} \quad P \div B = R$$

$$\left. S.\% \right\} \begin{array}{l} c\% + g\% \\ c\% - L\% \end{array}$$

$$B = Cost$$

$$Rate = Gain\ \% \ or\ Loss\ \%$$

$$P \left\{ \begin{array}{l} Gain \\ Loss \end{array} \right. \quad Cost\ \% = \\ 100\%$$

$$Net\ Price = Selling$$

$$S.P = \left\{ \begin{array}{l} c - L \\ c + g \end{array} \right.$$

$$1200 \qquad 3 \qquad 3\tfrac{1}{2}\ \%$$
$$10000 \qquad 6 \qquad 4\ \%$$

THE

ALEXANDER-DEWEY
ARITHMETIC

ADVANCED BOOK

BY

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The problem is always the same: to interest the pupil,
to induce research, to give him the notion continually,
the illusion, if you please, that he is discovering for
himself that which is being taught him. — M. LAISANT.

PREFACE

THIS series of arithmetics arises from the realization that the mathematics taught in the schools of a democracy must function in:

1. Clear and independent thinking as a preparation for business, science, and industry.
2. Skill in mathematical computation.
3. Civic responsibility which will carry into action whatever is needed for the welfare of the community.

That these ends may be accomplished, new arithmetical ideas have been introduced by means of the socialized recitation, thus affording the pupil an impelling incentive, cultivation of initiative and judgment, and a desire to check results. The arithmetical ideas gained through this social introduction are made automatic through scientific practice which later culminates in their application to new concrete situations. Reviews are both constant and varied. Fully fifty per cent of the work is to be performed without pencil. The subject matter is of contemporary interest which brings into the otherwise isolated schoolroom, the great world where mathematics is found in every basic activity. The desideratum is an intelligent, responsible, skillful pupil.

The respective contributions of the author and the editor of the series are perhaps sufficiently indicated by the use of these terms. The editor has made suggestions as to the underlying principles, has suggested experiments to be tested in schoolroom practice, has read and criticized the text and is jointly responsible for its present form. The specific problems and principles have been worked out in

iii

the schoolroom under the direct supervision of the author and tested till they were satisfactory. Grateful acknowledgment is made to the score of classroom teachers who have so generously and intelligently aided in testing the various lessons, and to Mrs. John Dewey, who has read the text critically and made valuable suggestions.

CONTENTS

The entire book is based on induction. Special exercises marked (*) should be assigned for study by the child alone. Exercises marked (†) are for exceptional classes only.

Additional Topics Used as Social Background for Mathematical Experience

ADVANCED BOOK

PART I — SECTION ONE

1. *The United States, the Farmer of the World.* *Graphs.*

1. The United States is the leading agricultural country in the world. In 1915, thirty million people, including farmers and their families, cultivated 280 million acres. How many acres, per person, were under cultivation?

2. In Belgium, in the same year, each person engaged in agriculture cultivated on the average 2.3 acres. In all 4,140,000 acres were cultivated. How many persons in Belgium were engaged in agriculture?

3. On this graph you will see that 2.3 blocks represent the acreage cultivated per person in Belgium. Copy the graph and add the acreage per person for the United States which you found in problem 1.
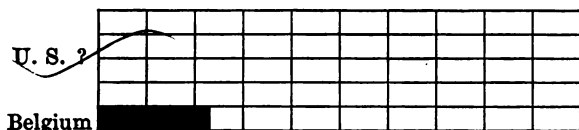
4. By intensive methods and careful fertilization, the yield per acre of wheat in Belgium was approximately 200 % of the yield in the United States. The average yield per acre in the United States was 14 bushels. Make a graph representing the comparative yield in the United States and in Belgium.

5. In the United States each person cultivated on the average 9.3 acres which yielded 14 bushels of wheat to the acre. In Belgium each cultivated 2.3 acres which yielded 28.6 bushels to the acre. In which country was the larger yield per person? How much?

6. The average yield per acre in Great Britain was 164 % of that in the United States. Make a graph representing the comparative yields of wheat per acre in the United States and in Great Britain in 1915.

2. *Change to equivalent per cents:*

1. $\frac{1}{4}$	6. $\frac{1}{8}$	11. $\frac{3}{8}$	16. $\frac{7}{20}$
2. $\frac{1}{5}$	7. $\frac{1}{6}$	12. $\frac{1}{3}$	17. $\frac{4}{25}$
3. $\frac{1}{20}$	8. $\frac{3}{4}$	13. $\frac{4}{5}$	18. $\frac{5}{8}$
4. $\frac{1}{25}$	9. $\frac{2}{5}$	14. $\frac{3}{20}$	19. $\frac{2}{3}$
5. $\frac{3}{10}$	10. $\frac{5}{6}$	15. $\frac{3}{5}$	20. $\frac{7}{8}$

Use for daily practice until the work becomes automatic.

3. * *Terms in Percentage and Miscellaneous Questions in Review.*

1. Belle answered correctly 8 questions in a list of 10; what per cent did she answer correctly? What per cent did she miss?

2. A spelling test paper containing 50 words was marked 90%; how many words were spelled correctly? How many were spelled incorrectly?

3. *For study.* Raymond's book contains 368 pages. He has read 75 % of it. How many pages has he read?

$$
\begin{array}{ll}
368 \text{ pages} & \text{BASE} \\
\underline{.75} & \text{RATE} \\
1840 & \\
2576 & \\
\overline{276.00} \text{ pages} & \text{PERCENTAGE}
\end{array}
$$

4. What is the meaning of the term *per cent?*

5. Write 5 per cent:

a. With the per cent sign. *b.* As a decimal. *c.* As a common fraction.

6. When the base is 200, the rate 4 %, what is the percentage?

4.
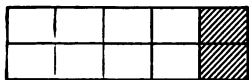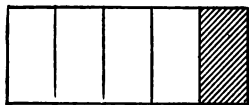
What per cent of each of these rectangles is shaded? How do you account for the fact that the per cent remains the same in all three?

Read the Preface, the Table of Contents and Suggestions to Teachers. Lessons marked * should be assigned for study previous to the recitation.

5. *Written Problems.*

1. A walked 3⅞ miles per hour for 4⅖ hours and B walked 4½ miles per hour for 3⅙ hours. Which walked the greater distance? How much greater?

2. Two boys bought a bicycle in partnership. One boy paid $16 or ⅖ of the cost. Find the amount paid by the other boy. Diagram.

3. A man's salary was increased ⅛. He then received $1800 a year. What was his salary before it was raised? Diagram.

4. If a railroad train averages 27.125 miles an hour, in what time will it run 303.8 miles?

5. Linen which cost $.60 a yard sold for $.75 a yard. What part of the cost is gained?

6. By selling a book for 90 cents, Mr. French lost ⅖ of its cost. How much had the book cost? Diagram.

7. How many bricks 8 in. × 4 in. will Mr. Allen require for a sidewalk 100 ft. 4 in. long and 4 ft. wide?

8. By selling a davenport for $84 a merchant gained ⅙ of the cost. How much had the davenport cost?

9. How long will it take a contractor to complete a sewer 3.02 miles long if he constructs 220 feet each day? 5280 ft. = 1 mi.

10. To-day Mrs. Mary Morton bought of W. R. Wilson & Company, 8 yd. of silk @ $1.75, 3 yd. velvet @ $2.87½, 6 yd. lace @ 81¼ cents, and 5 yd. gingham @ 35 cents. Make out and receipt the bill. Obtain actual bill heads.

11. If a man can do ⅞ of a piece of work in one day, what part of it can he do in ⅝ of a day?

12. A man bought a farm for $6250; he paid $1250 in cash. What part of the purchase price remained unpaid?

By daily practice habituate the pupils in estimating results and in checking them.

13. Living in 1914 and in 1919.

(a) W r i t e a statement show-ing what you un-derstand by the graphs.

(b) M a k e a n original problem based on data se-cured from this graph.
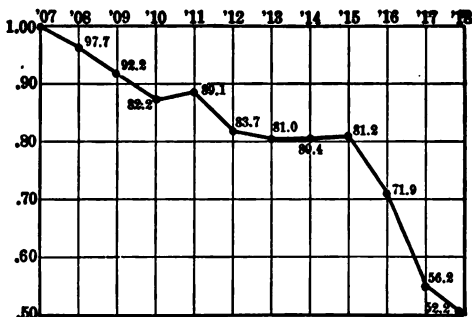
This graph shows the decrease in the purchas-ing power of the dollar from 1907 to 1918. From U. S. Government statistics.

14. One park has an area of 496 acres, and another has 49% as many. How many acres in the second park?

15. A man on an automobile trip stops for luncheon when the speedometer on his car shows that he has trav-eled 42.9 miles. At the end of the trip he finds he has traveled 171.6 miles. How many miles did he travel after luncheon?

16. Make an original problem about a trip across the Atlantic Ocean which will show that you understand some-thing about percentage. Make it so easy that the class can solve it without pencil.

17. A printer buys a stock of paper in sheets 3 ft. by $3\frac{1}{3}$ ft. He has to cut this into cards 6 in. by 4 in. How many cards can he cut from a sheet of stock?

18. What is the cost of $3\frac{3}{4}$ yd. silk at $1.75 per yd.?

19. If an oriental rug 8 feet by 10 feet costs $160, what should be the price of a rug of the same quality 12 feet wide and 20 feet long?

20. Women's shoes that sold for $6.00 in January, sold for 125% of that price in February. What was the new sale price?

6. *Without pencil:*

1. 75 % of 16 = ?   **6.** 2 % of 45 = ?   **11.** 4 % of 95 = ?

2. 60 % of 18 = ?   **7.** 20 % of 72 = ?   **12.** 12 % of 12 = ?

3. 120 % of 10 = ?   **8.** 3 % of 35 = ?   **13.** 8 % of 84 = ?

4. 10 % of 64 = ?   **9.** 110 % of 70 = ?   **14.** 30 % of 19 = ?

5. 5 % of 14 = ?   **10.** 6 % of 50 = ?   **15.** 40 % of 32 = ?

7. *Multiply:*

1. 764.25 by 879

2. 8.406 by 97.86

3. 4.967 by 809.4

4. 86.74 by 49.07

5. 98.004 by 7.98

6. .8653 by 6980

7. 649.8 by 9.007

8. 849.6 by 30.49

8. *Review Questions in Common Fractions.*

1. How does it affect the value of a fraction to multiply the numerator? To multiply both numerator and denominator by the same number?   Illustrate.

2. How does it affect the value of the fraction when you increase the size of the parts?   Which term of the fraction shows the size of the parts?

3. Reduce $\frac{9}{12}$ to a higher denomination. To a lower denomination.   What is meant by "reduction"?

4. Give two points of difference between a decimal fraction and a common fraction.   What is the correspondence between the number of decimal places in a decimal fraction and the number of ciphers in the denominator of its equivalent common fraction?

5. Give a rule for reducing a common fraction to a decimal

6. What is an aliquot part of a number?   Illustrate.

7. When an integer is multiplied by a fraction the product

is ——————————(larger or smaller?)——————————than the integer.

8. When an integer is divided by a fraction the quotient

is ——————————(larger or smaller?)—————————— than the integer.

9.† *Scientific Farming — Corn Clubs.*
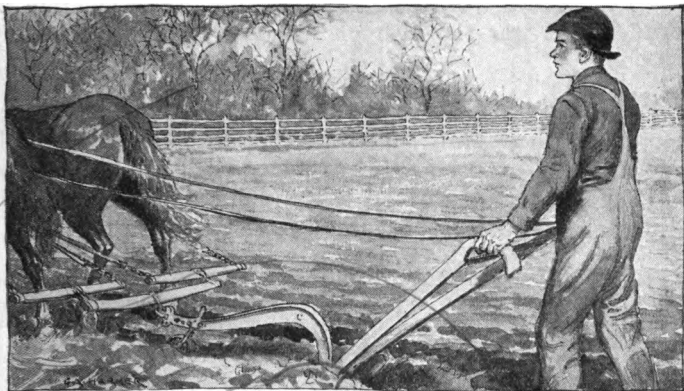
1. In the year 1910 Jerry Moore, a South Carolina boy, raised 228 bushels of corn on one acre of land, by scientific farming. At that time the average yield per acre in that state was 18.5 bushels. His yield was how many times the average yield?

2. In 1910 the corn crop of South Carolina was 17,000,000 bushels. As a direct result of Jerry's success, the corn crop three years later had increased to approximately 300 % of the yield in 1910. What was the yield in 1913? The yield in 1913 was how many more bushels than in 1910?

3. Corn clubs sprang up all over the country. In 1911 21 boys in Mississippi averaged 111 bushels to the acre at an average cost of 19¢ a bushel. Each boy cultivated one acre. What was the entire profit at 72¢ a bushel?

4. In 1913 there were 2400 Arkansas boys enrolled in corn clubs. They averaged 39.6 bushels to the acre. The state average was 17 bushels to the acre. The 2400 acres cultivated by the boys increased the state production how much?

† See Table of Contents.

5. During the summer of 1914, 2500 Ohio boys added $200,000 to the wealth of the state by the production of corn. What was the average value of the production by each boy?

6. The United States grows more corn than any other country in the world, her crop being 75 % of the world's crop (2,400,000,000 bu.). How many bushels are grown in the United States? Make a graph comparing the corn crop of the United States with that of the world.

7. In all the agricultural clubs there is a simple marking system of 100 points. The table below shows the assignment of credits:

    1. Greatest yield per acre.................. 30
    2. Best showing of profit on investment 30
    3. Best exhibit......................... 20
    4. Best-written account entitled:
            How I Made My Crop............ 20
        Total score........................ 100

In 1912 Merle Hyer of Utah raised 797 bushels of potatoes on an acre. His brother Ralph raised 840 bushels on an acre. How can you account for the fact that Merle received a higher rating than Ralph?

8. Maine, the best cropping state for potatoes, has never averaged above 220 bushels to the acre. This average yield per acre was what part of the amount that Ralph Hyer raised?

9. In the year 1915 there were 18,000,000 industrial workers in the United States. Of this number 36 % were farmers. How many farmers in the United States?

10. Between 1865 and 1915 the United States government spent $70,000,000 on the improvement of agriculture. What was the average expenditure per year?

10. *Change to decimals and to per cents:*

1. $\frac{9}{8}$ 4. $\frac{12}{15}$ 7. $\frac{5}{12}$ 10. $\frac{7}{12}$ 13. $\frac{3}{7}$ 16. $\frac{5}{3}$

2. $\frac{9}{12}$ 5. $\frac{15}{24}$ 8. $\frac{7}{6}$ 11. $\frac{25}{32}$ 14. $\frac{3}{11}$ 17. $\frac{8}{5}$

3. $\frac{5}{9}$ 6. $\frac{16}{6}$ 9. $\frac{9}{16}$ 12. $\frac{7}{4}$ 15. $\frac{7}{8}$ 18. $\frac{8}{9}$

11. *Solve by cancellation:*

1. $\frac{2}{7} \times 5\frac{1}{3} \times 2\frac{4}{5} \times 1\frac{3}{4} \times \frac{9}{24} \times \frac{15}{42} = ?$

2. $3\frac{4}{5} \times 1\frac{4}{38} \times 2\frac{1}{12} \times \frac{8}{21} \times \frac{9}{10} \times \frac{5}{12} = ?$

3. $6\frac{8}{9} \times 3\frac{9}{12} \times 5\frac{4}{5} \times \frac{7}{18} \times \frac{9}{7} \times \frac{7}{20} = ?$

4. $17\frac{1}{2} \times 1\frac{1}{7} \times 1\frac{1}{4} \times \frac{16}{25} \times \frac{3}{20} \times \frac{5}{12} = ?$

12. *Written Dictation.*

1. *Write in figures:* four hundred-thousandths.

2. 75 % of 24 = ?

3. A train leaving Louisville at 9:30 P.M. arrives in Birmingham the next morning at 9 A.M. How many hours between the cities?

4. Miss Washburn had 5 dozen stub pen points in her box and 30 % of that number of fine points. How many fine pen points had she?

5. A garden is 16 rods long. How wide must it be if it covers one acre?

13. *Find quotient:*

1. 13.5 ÷ 27   2. .324 ÷ 36   3. 581 ÷ 8.3   4. 2.76 ÷ 69
   135 ÷ 2.7   324 ÷ .36   58.1 ÷ .83   27.6 ÷ .69
   13.5 ÷ 2.7   32.4 ÷ 36   5.81 ÷ 83   2.76 ÷ 6.9
   135 ÷ .27   3.24 ÷ .36   .581 ÷ .83   276 ÷ .69

14. *Find the sum:*

1.	2.	3.	4.
$468\frac{5}{9}$	$387\frac{4}{13}$	$785\frac{5}{7}$	$872\frac{5}{16}$
$675\frac{3}{8}$	$965\frac{4}{5}$	$963\frac{2}{3}$	$236\frac{18}{32}$
$725\frac{2}{3}$	$472\frac{1}{2}$	$472\frac{5}{12}$	$948\frac{7}{48}$
$496\frac{5}{24}$	$389\frac{3}{4}$	$589\frac{13}{42}$	$789\frac{25}{96}$
$829\frac{5}{36}$	$547\frac{7}{20}$	$685\frac{7}{24}$	$635\frac{3}{4}$

15.* *A Strawberry Patch — Business Letters.*

                                              506 High Street
                                              Zanesville, Ohio
                                              May 1, 1920

The Montgomery Nursery
            Acton, Michigan.

Dear Sirs:

    Please find inclosed a money order for $3.70 for which kindly send the following strawberry plants:

    50 plants Burbank Special $0.95
    50 plants Everbearing................... .85
    50 plants Montgomery's Premier.......... 1.15
    50 plants Montgomery's Prize............ .75
                                            $3.70

Prompt delivery will be greatly appreciated.

                              Very truly yours,
            (Mrs. Earl J. Askren)   Ethel Askren.

1. Imagine yourself the shipping clerk at the Montgomery Nursery. Write the letter which is necessary to advise Mrs. Askren that you have that day filled and shipped her order. Continue.

2. Mrs. Askren planted 75 % of her plants in rows running east and west and the others in rows running north and south. How many plants were in each section?

3. In the year 1921 she sold 25 gallons of berries at 50¢ a quart and kept 50% of her berries for home use. What could she have sold her whole crop for?

4. During the year 1922 Mrs. Askren's yield of strawberries is only 72% of the crop of the previous year, what will it be worth at 50 cents a quart?

5. If in 1923 she realizes $128 from a crop yielding 40% of the quantity gathered in 1921, what is the price per gallon? What explanation have you for the fact that persons growing strawberries replant them every three years?

16.* *Commission.*

1. Lennis and Robbins, Real Estate Agents.
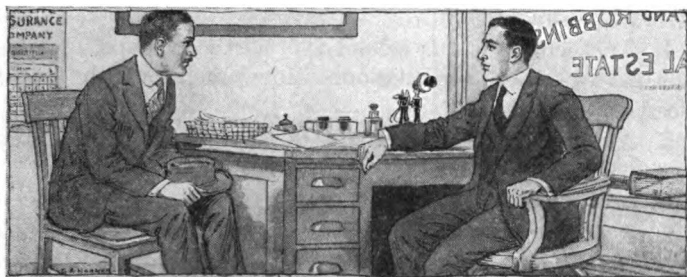
Mr. Robbins: Good morning, Mr. Crane. What can we do for you?

Mr. Crane: Good morning. I wish to sell my property on Spring Street.

Mr. Robbins: I know the property. What do you ask for it?

Mr. Crane: I think it should easily bring $8000. Your commission is 5 %?

Mr. Robbins: Yes. You would receive a net proceeds of 95 % of $8000 or $ ——.

Mr. Crane: Very well, you may price it at $8000.

A person who transacts business for another is an *agent* or *commission merchant.* The person for whom the business is done is the *principal.* The compensation of the agent is called the *commission.* The commission is always a percentage of the value of the property or of the consignment of goods. The sum left after the commission and other expenses have been paid is the *net proceeds.*

a. Name the agent in the lesson above. The principal. *b.* What was the rate of commission? What was the commission? *c.* What was the base? *d.* What was the amount of the net proceeds? Who would receive it?

2. A commission merchant sold 540 bushels of potatoes at $1.80 a bushel. Find his commission at 5%.

3. Find the commission, at 2%, on 300 tons of coal sold at $8.50 a ton.

4. An agent sells our school $85 worth of maps, and his firm pays him 7% commission. How much does the agent receive? The firm?

5. A real estate dealer rents 18 city apartments for the owner at $1400 each, and charges a commission of 3%. How much is the commission?

6. A salesman in a city department store sold goods during the six days of one week to the amount of $256.50, $102.25, $172.09, $142.81, $301.10, $52.25. He receives a commission of 2% on his sales. How much did he receive?

7. Find the commission at 2% on 1600 bushels of wheat sold at $2.20 a bushel. How much were the net proceeds?

8. A commission merchant sold 25 boxes of oranges each containing 12 dozen, at $.30 per dozen. Find his commission at 5%.

9. A commission merchant sells turkeys weighing 4250 pounds at 35¢ a pound. How much is his commission at 5%?

17. *At sight:*

1. $\frac{3}{5} \times 12$	**4.** $\frac{5}{6} \times 24$	**7.** $\frac{8}{9} \times 20$
$\frac{3}{5} \times 20$	$\frac{5}{6} \times 11$	$\frac{8}{9} \times 27$
2. $\frac{2}{3} \times 36$	**5.** $\frac{3}{8} \times 16$	**8.** $\frac{4}{5} \times 22$
$\frac{2}{3} \times 40$	$\frac{3}{8} \times 15$	$\frac{4}{5} \times 30$
3. $\frac{3}{4} \times 13$	**6.** $\frac{5}{7} \times 13$	**9.** $\frac{7}{8} \times 32$
$\frac{3}{4} \times 28$	$\frac{5}{7} \times 21$	$\frac{7}{8} \times 20$

18. *At sight:*

1. $\frac{1}{2} \div \frac{2}{3}$	**2.** $\frac{3}{4} \div \frac{1}{2}$	**3.** $\frac{1}{5} \div \frac{3}{4}$	**4.** $\frac{1}{7} \div \frac{5}{6}$
$\frac{2}{9} \div \frac{1}{8}$	$\frac{4}{7} \div \frac{1}{2}$	$\frac{1}{3} \div \frac{3}{4}$	$\frac{1}{6} \div \frac{5}{7}$
$\frac{6}{9} \div \frac{1}{3}$	$\frac{2}{3} \div \frac{1}{5}$	$\frac{3}{8} \div \frac{1}{6}$	$\frac{1}{8} \div \frac{4}{9}$

19. *Change to common fractions in lowest terms:*

1. 115 %	**6.** 47 %	**11.** 28 %	**16.** 156 %	**21.** 14 %
2. 65 %	**7.** 64 %	**12.** 32 %	**17.** 125 %	**22.** 66 %
3. 8 %	**8.** 75 %	**13.** 44 %	**18.** 15 %	**23.** 52 %
4. 72 %	**9.** 45 %	**14.** 24 %	**19.** 220 %	**24.** 124 %
5. 88 %	**10.** 96 %	**15.** 55 %	**20.** 150 %	**25.** 112 %

20. *Add and subtract:*

1. $2\frac{2}{3}$
$1\frac{3}{4}$

3. $4\frac{2}{5}$
$2\frac{1}{7}$

5. $6\frac{3}{4}$
$4\frac{2}{5}$

7. $4\frac{1}{7}$
$3\frac{5}{6}$

2. $3\frac{5}{6}$
$2\frac{1}{8}$

4. $5\frac{2}{5}$
$4\frac{1}{6}$

6. $7\frac{2}{9}$
$5\frac{1}{8}$

8. $8\frac{3}{4}$
$7\frac{2}{3}$

21. *Multiply:*

1. $9764\frac{7}{3}$
198

4. $27789\frac{7}{8}$
296

7. $47825\frac{5}{6}$
792

10. $1298\frac{4}{5}$
240

2. $4987\frac{3}{4}$
296

5. $1976\frac{6}{7}$
497

8. $7649\frac{2}{3}$
696

11. $2578\frac{3}{8}$
192

3. $37895\frac{5}{8}$
378

6. $2978\frac{5}{8}$
264

9. $3687\frac{3}{8}$
297

12. $6978\frac{3}{8}$
275

22. *Add:*

1. .707 + 8.58 + 196.6 + 8.968 + 977.37 + 6.998 + 10.07
2. .89 + 99.964 + 6.8 + 866.57 + 39.9 + 87.888 + 5.764
3. 7.97 + 28.688 + .58 + 967 + 9.9 + 89.87 + 6.789
4. 96.9 + 67.289 + 478 + 86.539 + 7.08 + 657.8 + 5.79
5. 9.8 + 40.769 + 95.6 + 579.88 + 98 + 9.97 + .897

23. *Solve at sight, using fractional equivalents:*

1. 75 % of \$480 = ?

5. $37\frac{1}{2}$ % of 48 yd. = ?

2. 80 % of \$25 = ?

6. $62\frac{1}{2}$ % of 640 A. = ?

3. 25 % of 320 rd. = ?

7. $87\frac{1}{2}$ % of 320 rd. = ?

4. $12\frac{1}{2}$ % of 90¢ = ?

8. 125 % of \$200 = ?

24. *Oral Problems.*

1. An agent charges 3 % commission for buying $100 worth of goods. What is the amount of his commission?

2. Charles misspelled 4 % of the words in the spelling test. There were 100 words in the test. How many words did he spell correctly?

3. A milk man starts on his round with 50 quart bottles of milk and 20 pint bottles. He delivers all but 4 quart bottles. How many quarts of milk has he sold?

4. A lawyer charged a commission of 5 % for collecting a debt of $1500. How much did he receive?

5. James has read 245 pages of his book which has in it 271 pages. How many pages has he yet to read?

6. There were 96 days in the school term. Alice was absent $16\frac{2}{3}$ % of the time. How many days was she absent?

7. A commission merchant sold 800 bushels of potatoes at $1.80 a bushel. If his commission was 4 %, how much did he receive?

8. A man died leaving two children, aged 9 and 15 years respectively. What was the age of the older child when the younger one was 18 years of age?

9. If 3 notebooks cost 20 cents, how much will 18 such books cost?

10. What will be the cost of 12 lb. macaroni @ 15¢?

11. Cloth which was bought at $2 a yard was sold at an advance of 10 %. What was the selling price?

12. How many pieces of tiling, each covering 12 square inches, will be required to lay a hearth 20 inches wide and 5 feet long?

13. A grocer mixed 50 pounds of tea. Forty per cent of the mixture was green tea. What per cent of the mixture was black tea? How many pounds of black tea?

14. What is the percentage when the base is 250 and the rate 5 %?

15. A real estate dealer sold a house for $6000. What were the proceeds of the sale after his commission of 5% was deducted?

16. I bought a basket containing 3 dozen oranges. Of these 25% were blood oranges. How many blood oranges did I buy?

17. What must I pay for 3 yards of ribbon when 8 yards are sold for $1?

18. How many feet in 3 rods?

19. Find the cost of a barrel of flour when $\frac{3}{8}$ of a barrel cost $4.50.

20. A book contains 240 pages. Nancy has read 75% of it. How many pages has she yet to read?

21. At $$\frac{4}{5}$ a lb., how many lbs. of tea can be bought for $5?

22. An automobile salesman received a commission of 25% on all cars sold. His sales amounted to $12,000. What was the amount of his commission?

23. A clerk who received $80 a month had his salary increased 25%. What was his salary after the increase?

24. If I pay 12¢ for 3 eggs, how much will I pay for 2 dozen eggs at the same rate? Ratio.

25. If I pay 72¢ for $1\frac{1}{2}$ doz. eggs, how much will I pay for 6 eggs at the same rate? Ratio.

26. Ethel Meade cut 64 pieces of fudge and gave $\frac{5}{8}$ of them away. What per cent of the fudge did she keep? How many pieces did she give away?

27. A freight train travels 15 miles in half an hour. An express train travels 25 miles in the same time. If they start at the same time and travel in the same direction on parallel tracks, how far apart will they be at the end of one hour?

28. Last year a farmer's wheat crop yielded 20 bushels to the acre. This year there was an increase of 25% to the acre. What was the yield per acre this year?

25. *At sight:*

1. 25 % of 24	**2.** 37½ % of 48	**3.** 50 % of 90
16⅔ % of 24	75 % of 56	62½ % of 72
12½ % of 24	35 % of 60	40 % of 70
33⅓ % of 24	87½ % of 40	66⅔ % of 75
		Continue.

26. *Subtract:*

1. 864⅜	**3.** 978⅘	**5.** 3578⅔	**7.** 9632⅑
398⅔	689⅚	1789¾	8765⅝
2. 986⅘	**4.** 796⅔	**6.** 6700⅞	**8.** 52385⁄7
869⅞	578⅞	5796⅘	3967¾

27. *Change to common fractions in their lowest terms:*

1. 48 %	**6.** 135 %	**11.** 102 %	**16.** 140 %
2. 68 %	**7.** 85 %	**12.** 84 %	**17.** 76 %
3. 54 %	**8.** 94 %	**13.** 78 %	**18.** 95 %
4. 36 %	**9.** 50 %	**14.** 215 %	**19.** 74 %
5. 118 %	**10.** 34 %	**15.** 35 %	**20.** 16 %

28. *Find the difference between:*

1. Ten thousand ten and one thousandth; and nine thousand eight hundred seven and nine thousand eight hundred fifty-six ten-thousandths.

2. Two million two hundred ninety thousand twenty-nine and ninety-two thousandths; and nine hundred seventy-five thousand seventy-five and eight tenths.

3. Nine hundred nine and nine hundred nine thousandths; and seven hundred thousand seven hundred two and seven hundredths.

4. Seven and nine thousand sixty-five ten-thousandths; and eighty-nine hundredths.

5. Five hundred and five hundredths; and six hundred thousand and six hundred-thousandths.

29. *Oral Problems.*

1. A stenographer who received $100 a month with a vacation on salary paid 75 % of her income for her living. How much can she save in one year?

2. Find the cost of 2500 bricks at $18 per thousand.

3. My gas bill for January is $3.80. What amount do I pay on February 3, if the Gas Company deducts 10 % from the amount, providing the bill is paid before the 10th of the following month?

4. A teacher of sewing allows 7 yards of gingham for 3 aprons. How much cloth must she buy for her class of 18 girls?

5. William bought a $45 canoe. By paying cash he received a discount of 5 %. How much did he save by paying cash?

6. A grocer bought 3 gallons of cream in half-pint bottles. How many bottles of cream did he buy?

7. If a man's salary of $56 a week was increased 12½ %, how much was it after the increase?

8. William, who is learning his trade, earns 18¢ an hour. He is required to work 8 hours a day. How much does he earn in 2½ days?

9. If the living expenses of a family were $40 a week two years ago, what are they now, when the cost of living has increased 40 %?

10. A dealer bought 10,000 bushels of wheat at $2.13 a bushel. After paying 3¢ a bushel storage, he sells at $2.20 a bushel. What is his gain?

11. A firm advertises its blankets as 75 % wool and the rest cotton. How much cotton in twenty 6-lb. blankets?

12. The flooring for a hall cost $360. The cost of laying and dressing it added 25 %. Find the whole cost.

13. A salesman received 8 % of his sales as his salary. How much did he earn one month when he sold $2000 worth of goods?

30. *Written Problems.*

1. Make a receipted bill of the following goods, supplying dates and names of the dealer and purchaser:

> May 7th, 75 lb. rice at $12\frac{1}{2}$ cents.
> May 14th, 10 lb. coffee at 42 cents.
> May 21st, 84 lb. sugar at $19\frac{1}{2}$ cents.

2. A floor 18 feet wide and 24 feet long is to be carpeted with carpet 27 inches wide. Which way should the strips run to use as few yards of carpet as possible? How many yards would be saved?

3. Mr. Stoddard raised 1680 bushels of wheat one year. If by fertilizing he increases the crop $37\frac{1}{2}\%$, how much does he then raise?

4. I bought a house for $4500 and paid $61 taxes on it. I then sold it so as to gain 10 % on the total amount thus expended. What was the selling price?

5. A farmer owns a 200-acre farm. He planted .25 of it in grass, .125 of it in corn, .5 in wheat and the remainder in oats. What per cent of his farm was planted in oats? How many acres?

6. What will it cost to fence a garden which is 12 rods square at $62\frac{1}{2}$ cents a foot?

7. At a special sale, all shoes were sold at $37\frac{1}{2}\%$ below the regular price. What were the sale prices of shoes, the regular prices of which were: $4; $4.80; $5.60; $6.40; $7.20?

8. Find the commission at the rate given on each consignment:

Consignment	Rate
a. 500 crates of berries sold at $4.50 a crate..	10 %
b. 100 crates of eggs at $12 a crate........	8 %
c. 150 bbl. of apples sold at $5 a barrel....	$16\frac{2}{3}\%$
d. 200 forty-pound tubs of butter sold at 40¢ a lb......................	5 %
e. 50 dressed lambs, 90 lb. each, sold at 20¢ a lb......................	5 %

31. *Find the commission (at sight):*

1. $345 at 2 %	**5.** $240 at 25 %	**9.** $650 at 6 %
2. $850 at 4 %	**6.** $360 at 10 %	**10.** $960 at $12\frac{1}{2}$ %
3. $360 at 5 %	**7.** $420 at 3 %	**11.** $300 at $16\frac{2}{3}$ %
4. $750 at 3 %	**8.** $350 at 2 %	**12.** $270 at $33\frac{1}{3}$ %

32. *Solve by cancellation:*

1. $\frac{19}{22} \times \frac{11}{38} \times 3\frac{6}{12} \times 5\frac{3}{12} \times \frac{16}{21} \times 1\frac{5}{7} = ?$

2. $\frac{5}{32} \times \frac{8}{20} \times 5\frac{1}{3} \times 3\frac{3}{4} \times \frac{10}{12} \times \frac{6}{25} = ?$

3. $\frac{18}{35} \times 7\frac{3}{6} \times 2\frac{1}{3} \times \frac{72}{81} \times 1\frac{7}{8} \times \frac{1}{32} = ?$

4. $4\frac{4}{5} \times 3\frac{3}{4} \times \frac{7}{8} \times 2\frac{2}{7} \times 1\frac{6}{9} \times \frac{1}{7} = ?$

33. *Find gain or loss (at sight):*

Cost:

1. $50, $12\frac{1}{2}$ % gain		**9.** $36, $11\frac{1}{9}$ % gain
2. $130, 10 % loss		**10.** $60, 3 % loss
3. $42, $16\frac{2}{3}$ % gain		**11.** $54, $16\frac{2}{3}$ % gain
4. $1.25, 4 % loss		**12.** $96, $6\frac{1}{4}$ % loss
5. 5 cents, 80 % gain		**13.** $72, $8\frac{1}{3}$ % gain
6. $30, $83\frac{1}{3}$ % gain		**14.** $90, 7 % loss
7. $56, $37\frac{1}{2}$ % loss		**15.** 8 cents, 75 % gain
8. 9 cents, $66\frac{2}{3}$ % gain		**16.** $35, $14\frac{2}{7}$ % loss

34. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
965	865	693	769	779	889
848	969	965	876	767	774
888	248	899	398	936	869
678	968	797	986	582	768
868	897	975	973	697	877
893	659	885	998	765	977
979	786	895	993	588	678
986	876	688	686	668	998
995	988	898	687	989	698
796	877	766	775	786	593

35.* *Simple Interest.*

Preliminary Exercise.

1.. I hired an automobile at the rate of $3 an hour. How much did I pay for the *use* of it for 5 hours?

2. I rented a boat at $.25 an hour. How much did I pay for it after *using* it 4 hours?

3. I borrowed $100 for 1 year for the *use* of which I agreed to pay 6 % of the $100. How much did I pay for the *use* of it?

Money paid for the *use* of money is *interest*. The money borrowed is the *principal*. Interest is reckoned as a certain per cent of the principal.

---

36. *At sight:*

1. 2 % of 30	**3.** 1 % of 15	**5.** 4 % of 75	**7.** 50 % of 20
98 % of 30	99 % of 15	96 % of 75	51 % of 20
2. 2 % of 8	**4.** 15 % of 60	**6.** 30 % of 90	**8.** 7 % of 50
102 % of 8	150 % of 60	103 % of 90	107 % of 50
120 % of 8	105 % of 60	3 % of 90	170 % of 50

37. *Written Problems in Commission.*

1. A commission merchant sells wheat to the amount of $12,000, on a commission of 2 %. What sum does he receive for his services?

2. A broker sells 40,000 pounds of cotton at 35¢ a pound. What is the amount of his commission at $2\frac{1}{2}$ %?

3. A commission merchant in Minneapolis sold $6000 worth of wheat for a Montana farmer. What was his commission at 2 %?

4. Make an original problem in commission in which you are the agent. Make it so easy that the problem can be solved orally.

38.* *Borrowing Money.*
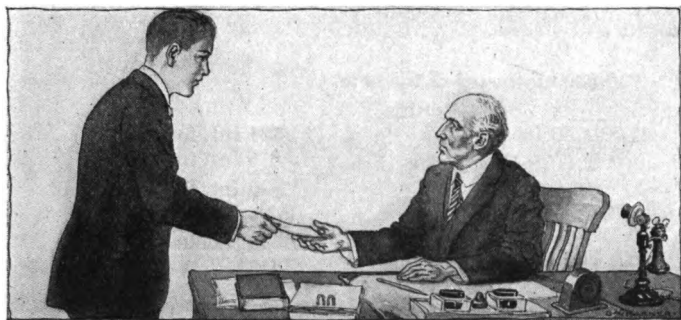
Mr. Beardsley (shaking hands with Frank): I am proud of the record you have made at school, Frank. I am ready to keep my promise to lend you whatever money you need to complete your college course.

Frank: Thank you, Uncle. I have calculated carefully and I think $300 in addition to what I can earn will be sufficient. I am promised a position with the Miller Drug Company as soon as I am through.

Mr. Beardsley: You are fortunate. That is a fine company. Don't let the debt worry you. You may have three years in which to pay it.

Frank: Thank you, but that is too long. I am sure I can pay you in two years. I have written out this note:

$300   Chicago, Ill., *Jan. 3, 1920*
................*Two years*..............after date I promise to pay
.................................*William Beardsley*.........................
Three hundred ——————————————————Dollars
~~with interest~~ at four per cent.   Value received.
                                    Frank Williams

Frank overworked himself and was taken ill. His pay·ment of the note was consequently delayed six months. Mr. Beardsley gladly extended the time of payment. What amount did Frank pay his uncle?

$300 Principal of the note.
 .04
12)$12.00 Int. for 1 yr.
 $ 1.00 Int. for 1 mo.

$24 Int. for 2 yr.
$ 6 Int. for 6 mo.
$30 Int. for 3 yr. 6 mo.
$300 Principal
$330 Amount due.

Frank paid his uncle $330.

A note promising to pay a debt is called a *promissory note*. The one who signs the note is the *maker* of the note. The one to whom it is to be paid is the *payee*. The sum loaned is called the *face* of the note and the face plus the interest is the *amount*. The sum loaned is also called the *principal*.

1. Who was the maker of the note on the foregoing page?

2. Who was the payee?

3. What was the face of the note? What was the principal?

4. How was the amount found?

39. *Find the amount due on:*

1. $572 for 4 mo. at 6 %.

2. $650 for 6 mo. at 5 %.

3. $1200 for 1 yr. 9 mo. at 6 %.

4. $2700 for 1 yr. 3 mo. at 6 %.

5. $4300 for 4 yr. 4 mo. at 5 %.

6. $5400 for 3 yr. 7 mo. at 4 %.

7. $3580 for 3 yr. 9 mo. at 4 %.

8. $3750 for 3 yr. 8 mo. at 4 %.

9. $6725 for 2 yr. 8 mo. at 6 %.

10. $5635 for 3 yr. 3 mo. at 4 %.

11. $8540 for 1 yr. 4 mo. at 3 %.

12. $7980 for 2 yr. 5 mo. at 7 %.

40. *Rapid practice:*

10 % of	50 % of	20 % of	12½ % of	25 % of
30 *3*	24 *12*	35 *7*	40 *5*	36 *9*
50 *5*	38 *19*	60 *12*	56 *7*	60 *15*
70 *7*	42 *21*	65 *13*	32 *4*	72 *18*
90 *9*	70 *35*	85 *17*	72 *9*	96 *24*

41.

12½ % of	33⅓ % of	75 % of	60 % of	87½ % of
24 *3*	24 *8*	20 *15*	80 *48*	16
40 *5*	81 *27*	28 *21*	60 *36*	32
16 *2*	54 *18*	32 *24*	75 *45*	40
48 *6*	87 *29*	56 *42*	35 *21*	96

42. *Find quotient:*

1. 6054.05 ÷ 2.87   4. 38,777.2 ÷ 19.8
2. 2561.92 ÷ .274   5. 75,606.2 ÷ 3.69
3. 4071.92 ÷ 46.8   6. 5,452.45 ÷ .397

43. *Find the interest on:*

1. $800 for 3 yr. at 6 %.   4. $2400 for 5 yr. at 5 %.
2. $615 for 4 yr. at 5 %.   5. $3180 for 4 yr. at 5 %.
3. $318 for 2 yr. at 7 %.   6. $5648 for 4½ yr. at 6 %.

44. *Written Dictation.*

1. ¾ of anything is what per cent of it?

2. 8.3 + 1.9 = ?

3. Ellen had 50 cents. She spent 70 % of her money for a tea set for her dolls. How much had she left?

4. Ralph and James went fishing. Ralph caught 20 fish and James 25 % more than Ralph. How many fish did both boys catch?

5. After selling ⅔ of his flock, a farmer had 60 sheep left. How many sheep were in the flock at first?

45.† *Scientific Farming — Pig Clubs.*
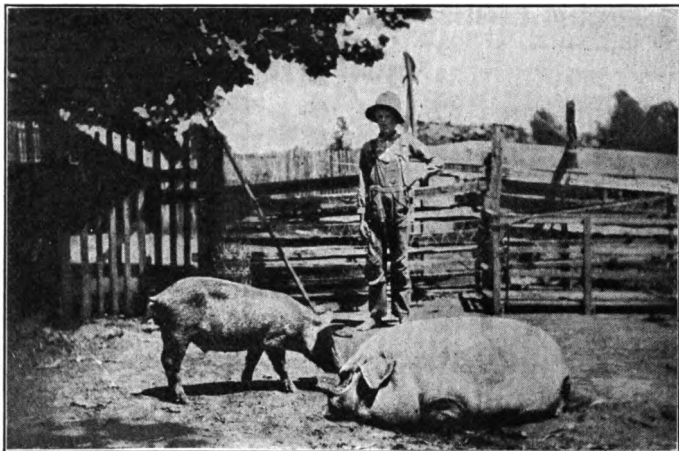
1. Orange McGee of Goldona, Louisiana, in 1914 entered into a friendly rivalry with a neighboring farmer as to which could raise the better pig. The two pigs were 8 weeks old when the contest began. The farmer used the old plan of pork culture and spent $5. Orange McGee used the new way recommended by the United States Department of Agriculture. He spent $15.54 to raise his pig. When shown at the Shreveport state fair, Orange's pig weighed 485 pounds and sold for $58. The farmer's pig weighed 65 pounds and sold for $8. Orange's pig gave how many more pounds of pork than the other? How much more did Orange clear than the farmer?

2. In 1914 the secretary of the Chamber of Commerce, Waco, Texas, persuaded the business men to finance boys with pure-blooded pigs at $10 each. He offered their notes at 6 %. Imagine yourself to be one of these boys and give your note for 6 months. In the lower left-hand corner of your note write the statement, "I hereby promise to raise not less than half an acre of feed for the pig."

<div align="center">† See Table of Contents.</div>

3. Corn is fed to pigs because it contains 67 % of carbohydrates which give fat and energy to the animal. Find the amount of carbohydrates in 10 bushels of corn. One bushel weighs 56 pounds.

4. The Department of Agriculture recommends a balanced ration for pigs consisting of $66\frac{2}{3}$ % corn together with $33\frac{1}{3}$ % milk. Make a graph representing this.

5. A common practice on good farms is to turn the hogs into the corn field to harvest the crop. Isaac Breeding of Edinburg, Indiana, turned 36 hogs into 4 acres of corn. Fill out the blanks in the following:

	36 Hogs	*Per Hog*
Initial wt. (Oct. 11th)	5310 lb.	—— lb.
Final wt. (Nov. 12th)	7880 lb.	—— lb.
Gain (32 days)	—— lb.	—— lb.
Average daily gain per hog		—— lb.

6. Experiment shows that the average amount of grain required to produce a pound of pork is 5 pounds. If a pig is turned into clover only $66\frac{2}{3}$ % of that amount of grain is needed. How much grain is saved per pound of pork by turning a pig into clover?

7. If a pig gained 75 pounds during the time it was in clover, how many pounds of grain were saved?

8. A farmer has a lot of pigs. Corn is worth $1.95 per bushel on the local market. By feeding 6 bushels of corn to each of his pigs, a farmer can increase its weight 100 pounds. The pigs will then bring him $19.50 per 100 lb. Will it pay him to feed them and how much?

46. *At sight:*

1.
$\frac{7}{8} + \frac{1}{2}$
$\frac{7}{8} - \frac{1}{2}$
$\frac{7}{8} \times \frac{1}{2}$
$\frac{7}{8} \div \frac{1}{2}$
$\frac{1}{2} \div \frac{7}{8}$

2.
$\frac{3}{4} + \frac{1}{2}$
$\frac{3}{4} - \frac{1}{2}$
$\frac{3}{4} \times \frac{1}{2}$
$\frac{3}{4} \div \frac{1}{2}$
$\frac{1}{2} \div \frac{3}{4}$

3.
$\frac{5}{6} + \frac{1}{3}$
$\frac{5}{6} - \frac{1}{3}$
$\frac{5}{6} \times \frac{1}{3}$
$\frac{5}{6} \div \frac{1}{3}$
$\frac{1}{3} \div \frac{5}{6}$

47. *Oral Problems.*

   1. Three quarts are what per cent of a gallon?

   2. Eight ounces are what per cent of a pound?

   3. Thirty-six minutes are what per cent of an hour?

   4. Helen read 40 pages of a book containing 64 pages. What per cent of the book has she still to read?

   5. In an orchard of 350 trees 4 % were plum trees. How many plum trees were there?

   6. Mr. Moore had $200 and paid 11 % of it for an overcoat. How much did the overcoat cost?

   7. A commission merchant sold $348 worth of fruit. What was his commission at 2 %?

   8. I borrowed $400 for 2 years at 6 %. What amount did I pay at the end of that time?

   9. Mr. Allen with his wife and four children went to the city. At the village station he paid $1.80 for each whole ticket and half price for the youngest child. How much did he pay for all?

   10. At 5¢ an ounce, find the cost of $1\frac{1}{2}$ pounds of pepper.

   11. William gathered 2 bushels of walnuts and sold 15 quarts. How many quarts had he left?

   12. A farmer delivered 3000 pounds of milk to a creamery. It tested 4 % butter fat. What was the weight of the butter fat?

   13. A dealer pays 9¢ per pound for onions. For how much must he sell them to make a profit of $33\frac{1}{3}$ %?

   14. A grocer sold 5 pounds of butter to one customer and 2 times that amount to another. At 50 cents a pound, how much should he receive from the two sales?

   15. Mr. Osborne borrowed $465 for 3 months at 4 %. What interest did he pay?

16. A lawyer collected a debt of $600. What was his commission at $2\frac{1}{2}$ %?

17. A plot of ground is 26 feet long and 18 feet wide. How many feet of fence will be required to inclose it?

18. For how much a peck must a dealer sell peaches costing $3.20 per bushel to make a profit of 25 %?

19. In a certain village there are 1760 people. Of this number $87\frac{1}{2}$ % are native born. How many foreign born people in the village?

20. Mr. Layman invested $3600 in business, and a year later increased his capital $16\frac{2}{3}$ %. How much was his capital then?

21. If the profit on three cakes of soap is 10¢, how much profit will be made on 12 cakes of soap?

22. I have $16\frac{1}{2}$ pounds of candy. How many pounds shall I have after selling 9 half-pound boxes of candy?

23. Formerly there were 300 fishermen in a certain village. There are now only 95 % of that number. How many fishermen now in the village?

24. I have two pieces of land containing respectively 63 and 70 acres. I wish to divide them into fields of uniform size. What is the largest field that I can make?

25. Margaret has $1\frac{1}{2}$ yards of ribbon on her hat and $66\frac{2}{3}$ % of that amount in a bow on her hair. How long is her hair ribbon?

26. A grocer's sales average $1200 per week. If 30 % of his sales are profit, what is the amount of his weekly profit?

27. Grace weighed 96 pounds. At the end of a year she had gained $12\frac{1}{2}$ % in weight. What was her weight then?

28. Robert bought a bicycle for $40 and sold it at the end of six months for $36. What was the per cent of his loss?

48.* *Interest — Months and Days.*

See pp. 20, 21, 22 for previous lessons.

1. *For study.* Find the interest on $600 for 7 mo. 14 days at 8%.

<div align="center">Solution</div>

$600	
.08	
12)$48.00 Int. for 1 yr.	$28.000 Int. for 7 mo.
30)$ 4.00 Int. for 1 mo.	$ 1.862 Int. for 14 da.
$ .133 Int. for 1 da.	$29.86 Int. for 7 mo. 14 da.

Carry all computations three decimal places until the answer is reached.   5 mills and over should then be counted as a full cent.

Find the interest on:

2–3. $55, 4%, 5 mo. 10 da.; 3 mo. 6 da.

4–5. $350, 2%, 7 mo. 15 da.; 6 mo. 20 da.

6–7. $150, 5%, 2 mo. 12 da.; 4 mo. 15 da.

8–9. $275, 3%, 9 mo. 10 da.; 5 mo. 12 da.

10–11. $425, 6%, 4 mo. 24 da.; 1 mo. 18 da.

12–13. $560, 6%, 1 mo. 15 da.; 9 mo. 18 da.

14–15. $750, 5%, 3 mo. 18 da.; 10 mo. 15 da.

16–17. $680, 8%, 2 mo. 20 da.; 1 mo. 24 da.

Find the amount of:

18–19. $300, 5%, 2 yr. 1 mo. 6 da.; 1 yr. 7 mo. 6 da.

20–21. $250, 6%, 1 yr. 1 mo. 10 da.; 2 yr. 4 mo. 24 da.

22–23. $460, 4%, 3 yr. 8 mo. 24 da.; 3 yr. 6 mo. 12 da.

24–25. $575, 2%, 2 yr. 5 mo. 18 da.; 5 yr. 8 mo. 12 da.

26–27. $340, 3%, 4 yr. 7 mo. 15 da.; 4 yr. 10 mo. 20 da.

28–29. $775, 6%, 5 yr. 10 mo. 12 da.; 3 yr. 10 mo. 24 da.

30–31. $325, 8%, 2 yr. 8 mo. 10 da.; 3 yr. 3 mo. 15 da.

32–33. $450, 4%, 4 yr. 3 mo. 6 da.; 2 yr. 5 mo. 15 da.

49. *Written Problems.*

1. How many square feet of surface are in the top of a table 3 feet long and 2½ feet wide? Make a drawing on the scale of an inch to a foot.

2. Mr. Denny has paid 85 % of a debt of $12,500. How much remains unpaid?

3. What is the cost of 128 yards of silk at 87½¢ a yard?

4. *a.* At 37½ miles per hour, how far will a train go in 50 hours? *b.* At 37½ miles per hour, how long will it take a train to go 50 miles?

5. A dealer bought hats at $36 per dozen and sold them at a profit of 33⅓%. At what price was each hat sold?

6. What is the weight of water in a bag of chestnuts weighing 36 pounds if 40 % of the weight is water?

7. How much commission was received for selling 50 barrels of potatoes at $7 per barrel, if the rate of commission was 4 %?

8. Find the interest on the following note:

$4000   Oswego, N. Y., Nov. 20, 1919.

Three months after date, for value received, I promise to pay to H. H. Stewart, Four Thousand Dollars with interest at 6%.

                                                J. E. Merrill.

9. How much cooked meat will 36 pounds of raw meat supply when 25 % of the weight of the latter is lost in cooking?

10. I borrowed $150 agreeing to pay 5 % interest. At the end of 2 years 6 months, I paid the interest and the principal. How much did I pay?

11. A farmer has raised 4200 bushels of wheat. How many bushels has he after selling 37½ % of the crop?

12. A road supposed to be 12 miles long is found to be 16⅔ % of a mile short of that length. What is its length in miles and rods?

13. The product is 52.05 and the multiplicand 34.7. What is the multiplier?

14. I loaned $450 at 6% on November 5, 1919. What was the amount paid me November 5, 1921?

15. The weekly payroll of a factory is $5500. What would it be if it were increased 6%?

16. If a man can do $\frac{2}{3}$ of a piece of work in $2\frac{2}{3}$ days, how long will it take him to do all of the work?

17. A man pays $5600 for a shipment of wheat at $.87$\frac{1}{2}$ per bushel. How many bushels does he receive? Solve in the shortest way that you can.

18. A man loses $16\frac{2}{3}$% of his money and then loses 20% of the remainder. *a.* What fraction of his money has he lost? *b.* What per cent of his money?

19. A book agent's sales one month amounted to $375. How much did he make that month if his commission was $33\frac{1}{3}$%?

20. A shipment of live chickens weighs 396 pounds. If the chickens shrink 29% on being dressed, what will be the weight of the chickens after being dressed?

21. What is the interest on $2400 for 2 years 4 months at 6%?

22. A western land company advertised that money invested in their lands would yield a profit of 25% in two years. At this rate how much would the profit be on $7000 thus invested?

23. Make out and receipt a bill for: $2\frac{1}{2}$ yards of ribbon at 80¢ a yd., 6 spools of cotton thread at 5¢, 3 papers of needles at 8¢, and one box of dressmaker's pins at 20¢.

24. In a large storage house 15% of a stock of 2480 bushels of apples spoiled. How many apples remained in good condition?

25. At 18¢ a square foot, find the cost of a hard wood floor 20 feet 6 inches long by 16 feet wide.

26. One year a farmer averaged $40 an acre from a crop on 16 acres of wet land. After draining the land his crop increased $37\frac{1}{2}$% in value. What was the value of the second year's crop?

50.* *Solve by long multiplication and by aliquot parts:*

1. *For study.* $25 \times 36 = ?$

$$
\begin{array}{r}
a. \quad 36 \\
25 \\
\hline
180 \\
72 \\
\hline
900
\end{array}
\qquad\qquad
b. \quad 25 = \frac{100}{4} \\
9 \\
\frac{100}{4} \times \frac{36}{1} = 900
$$

$$25 \times 36 = 900$$

2. $20 \times 18 = ?$	**5.** $75 \times 28 = ?$	**8.** $80 \times 25 = ?$
3. $40 \times 25 = ?$	**6.** $50 \times 18 = ?$	**9.** $37\frac{1}{2} \times 16 = ?$
4. $12\frac{1}{2} \times 48 = ?$	**7.** $62\frac{1}{2} \times 32 = ?$	**10.** $87\frac{1}{2} \times 24 = ?$

51. *Find quotient at sight:*

1. $19.6 \div 1.4$	**2.** $.169 \div 1.3$	**3.** $1.21 \div 1.1$
$.196 \div .14$	$1.69 \div 13$	$121 \div .11$
$1.96 \div 14$	$169 \div 1.3$	$.121 \div .11$
$196 \div .14$	$16.9 \div .13$	$12.1 \div 11$

52. *Express with the sign %:*

1. .03	**5.** .0125	**9.** .375	**13.** $.4\frac{1}{2}$
2. .35	**6.** .125	**10.** .55	**14.** $.04\frac{1}{2}$
3. 3.5	**7.** .60	**11.** .055	**15.** 4.5
4. .035	**8.** .06	**12.** 7.00	**16.** .045

53. *Give rules for the following: Illustrate each.*

1. Reduction of fractions to equivalent fractions of another denomination.

2. Subtraction of one mixed number from another in which the fraction in the subtrahend is larger than the fraction in the minuend.

3. Multiplication of a fraction by an integer in two ways.

4. Division of a fraction by a fraction.

5. Finding a fractional part of a number.

6. Finding a number when a fractional part of it is given.

54.* *Finding the Value of the Whole when that of a Part is Given — Percentage.*

1. *For study.* In a certain school there are 280 pupils who are foreign born. This is 40 % of the entire number of pupils. How many pupils are in the entire school?

<div align="center">

Solution by Unitary Analysis

</div>

Common Fractions	Percentage
40 % = ⅖	40 % of all the pupils = 280 pupils
⅖ of all the pupils = 280 pupils	1 % of all the pupils =
⅕ of all the pupils = 140 pupils	280 pupils ÷ 40 = 7 pupils
⅖ or all the pupils = 700 pupils	100 % or all the pupils = 700 pupils

<div align="center">

There are 700 pupils in the entire school.

</div>

Make sure that the class thoroughly understand the principle involved. Ample preparation for this difficult step was given in Intermediate book. No attempt should be made at this time to shorten the process.

2. A poultry raiser set some eggs. O. these 15 % failed to hatch. The number failing to hatch being 30, how many did the poultry raiser set?

3. A farmer sold 10 cows for $320. This was 80 % of the original cost of the herd. How much had all the cows cost him?

4. A man saves $840 a year. This is 30 % of his income. How much is his income?

5. From a tank of oil 15 % leaked out. There remained 170 gallons. How many gallons were in the tank at first?

6. A farmer tested some kernels of corn to see how many would grow. Of the number planted 12 % failed to grow while 352 kernels did grow. How many kernels did he plant?

7. A boy missed 2 words in his spelling test and spelled 96 % of his words correctly. How many words in the spelling test?

8. Find the number of which:

a. 12 is 20 %.	*c.* 32 is 4 %.	*e.* 25 is 20 %.
b. 20 is 12½ %.	*d.* 40 is 25 %.	*f.* 20 is 125 %.

55. *Find the commission on:*

1. $360 at 2%	**4.** $540 at 4%	**7.** $260 at 5%	**10.** $150 at 2%
2. $620 at 5%	**5.** $450 at 8%	**8.** $960 at 6%	**11.** $360 at 5%
3. $325 at 2%	**6.** $420 at 5%	**9.** $720 at 3%	**12.** $340 at 5%

56. *Subtract:*

1. $7586\frac{3}{4}$ $5979\frac{3}{9}$	**3.** $5986\frac{5}{8}$ $4789\frac{7}{9}$	**5.** $9586\frac{1}{3}$ $8976\frac{2}{3}$	**7.** $8647\frac{1}{4}$ $7989\frac{5}{9}$
2. $9687\frac{2}{7}$ $9479\frac{1}{3}$	**4.** $4325\frac{2}{9}$ $3897\frac{1}{4}$	**6.** $8972\frac{1}{4}$ $7996\frac{2}{3}$	**8.** $2362\frac{3}{8}$ $2296\frac{2}{3}$

57. *At sight:*

1. 1 is what part of 8?
$\frac{1}{2}$ is what part of 8?
$\frac{1}{4}$ is what part of 8?
$\frac{3}{4}$ is what part of 8?

2. 1 is what part of 3?
$\frac{1}{2}$ is what part of 3?
$\frac{1}{4}$ is what part of 3?
$\frac{3}{4}$ is what part of 3?

3. $\frac{1}{4}$ is what part of 1?
$\frac{1}{8}$ is what part of 2?
$\frac{1}{8}$ is what part of 4?
$\frac{1}{8}$ is what part of 3?

4. $\frac{1}{3}$ is what part of 1?
$\frac{1}{3}$ is what part of 2?
$\frac{1}{3}$ is what part of 4?
$\frac{1}{3}$ is what part of 12?

58. *Add.*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
969	799	475	575	589	698
578	957	689	438	884	785
564	775	956	678	885	396
397	749	599	798	656	988
896	587	999	639	996	775
289	854	799	873	876	868
898	968	997	989	999	699
668	689	859	869	386	765
987	996	885	489	982	799
876	798	978	769	579	678

59. *Written Problems (consult Table in the Appendix).*

1.† In August, 1914, at the outbreak of the war, an American school teacher found she could not reach Liverpool, where her return passage was booked. She cabled her father to send her $150 immediately that she might secure passage from Naples. Obtain a cablegram from the Western Union. Imagine yourself to be Mr. Henry W. Spencer, of Toledo, Ohio. Send to your daughter, Miss Adelaide Spencer, $150 (in Italian money) to her address, Hotel DeRoma, 45 Mercato Vecchio, Naples, Italy.

2. Each month Norah O'Haver, a young Irish woman, sends 2 £ in English money to her mother in Belfast. How much change did she receive from a $10 bill after paying 10¢ for her money order at the post office? Why did Norah send English money to Ireland? What postage did she pay on her letter to her mother?

Get day's quotation from post office or newspaper.

3.† An educational committee in Russia wrote to a school official in this country asking for information about American schools. The committee sent an American Express money order amounting to $40 to pay for books and supplies for a school in Russia. The American Express agent in Moscow had received what amount of Russian money for this?

4.† Chang Woo Sin, a Chinese nobleman, wishing to give his 18-year-old son the benefit of an American education, sent him to Columbia University with a letter of credit amounting to $1500. A letter of credit is bought at a bank. The one thousand five hundred dollars in American money was worth how much in Chinese money?

5. The buyer for the woman's ready-to-wear department in a large Philadelphia store bought two dresses in Paris designed by a famous Parisian costumer paying 500 francs for one and 480 francs for the other. What was the equivalent value in American money?

6. Make an original problem about two little girls who received a Christmas gift from their grandmother in Venice.

† See Table of Contents.

60.* *Profit and Loss — Relations of Cost and Selling Price.*

1. *For study.*

a. A house that cost $5000 was sold at an advance of 20%. What was the selling price?

b. A house was sold for $6000. This was an advance of 20% over the cost price. What was the cost price?

I. By Common Fractions

a. $\frac{5}{5}$ or c. = $5000

b. $\frac{5}{5}$ or c. = ?
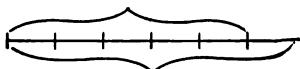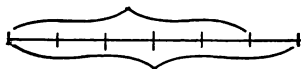
$\frac{6}{5}$ of c. = ?

20% = $\frac{1}{5}$

$\frac{5}{5}$ or c. = $5000

$\frac{1}{5}$ of c. = $1000 (or g.)

$\frac{6}{5}$ of c. = $6000

$\frac{6}{5}$ of c. = $6000

20% = $\frac{1}{5}$

$\frac{6}{5}$ of c. = $6000

$\frac{1}{5}$ of c. = $1000 (or g.)

$\frac{5}{5}$ or c. = $5000

II. By Percentage

a. 100% or c. = $5000

1% of c. = $50

120% of c. = $6000

The house sold for $6000.

b. 120% of c. = $6000

1% of c. = $50

100% or c. = $5000

The house cost $5000.

Through a class discussion lead pupils to a realization that "cost price" usually includes such items as advertising, interest on money invested, rent for warehouses, freight, salaries of agents, etc., etc. Perhaps pupils in the class can furnish data for some actual problems. Those presented in this book do not usually specify these complications for obvious reasons. Such complications do not change the principle involved. See "Gross and Net Profits," page 225.

2. Solve by fractions and by percentage:

a. A piano that cost $800 was sold at a loss of 25%. What was the selling price?

b. A piano was sold for $600. This was a loss of 20% of the cost price. What was the cost price?

3. When a hat that cost $3.50 was sold at an advance of 50%, what was the selling price? State and solve the reciprocal problem.

61. *Supply the reciprocal problem:*

   1. *a.* $\frac{2}{3}$ of 75 = ?   *b.* 50 is $\frac{2}{3}$ of ?
   2. *a.* 80 is $\frac{5}{4}$ of ?
   3. *a.* $\frac{3}{4}$ of 60 = ?
   4. *a.* 150 is $\frac{6}{5}$ of ?
   5. *a.* $\frac{4}{5}$ of 80 = ?
   6. *a.* 60 is $\frac{3}{4}$ of ?

62. *Written Dictation.*

   1. 30 is 6 % of what number?

   2. 18 is what part of 24?

   3. Porterhouse steak which had been selling at 30¢ a pound increased in price $16\frac{2}{3}$ %. At what price was it then selling?

   4. I paid $18 for 6 flags. At that rate, how many flags could be bought for $36?

   5. Mr. Adams withdrew $40 from the bank. This was 80 % of all he had on deposit. What was the full amount of his deposit?

63. *At sight:*

1. $\frac{2}{3} \div \frac{3}{4}$	**6.** $\frac{3}{8} \div \frac{2}{3}$	**11.** $\frac{8}{9} \div \frac{3}{4}$
2. $\frac{4}{5} \div \frac{1}{6}$	**7.** $\frac{5}{8} \div \frac{4}{5}$	**12.** $\frac{6}{7} \div \frac{5}{6}$
3. $\frac{5}{6} \div \frac{2}{7}$	**8.** $\frac{2}{3} \div \frac{7}{8}$	**13.** $\frac{5}{6} \div \frac{6}{7}$
4. $\frac{3}{4} \div \frac{2}{3}$	**9.** $\frac{3}{5} \div \frac{5}{8}$	**14.** $\frac{3}{7} \div \frac{2}{3}$
5. $\frac{7}{9} \div \frac{1}{4}$	**10.** $\frac{7}{8} \div \frac{2}{5}$	**15.** $\frac{2}{9} \div \frac{3}{4}$

64. *What number decreased by:*

   1. $12\frac{1}{2}$ % of itself = 21?   **6.** 40 % of itself = 24?
   2. $16\frac{2}{3}$ % of itself = 45?   **7.** 25 % of itself = 27?
   3. $37\frac{1}{2}$ % of itself = 20?   **8.** $66\frac{2}{3}$ % of itself = 8?
   4. $33\frac{1}{3}$ % of itself = 16?   **9.** $87\frac{1}{2}$ % of itself = 5?
   5. $62\frac{1}{2}$ % of itself = 6?   **10.** $83\frac{1}{3}$ % of itself = 8?

65. *The First Flight across the English Channel.*

On July 25, 1909, Louis Bleriot (Blĕ-ri-ō′), starting from Calais in a small airplane, made the first successful flight across the English Channel. His own words are:
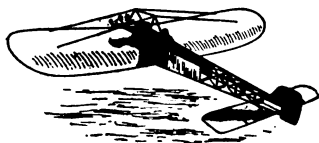
"I begin my flight, steady and sure. I have no apprehension, no sensation, *pas du tout.* The *Escopette* has seen me. She makes perhaps 42 kilometers (—— miles) an hour. What matters? I am making at least 68 kilometers (—— miles). Rapidly I overtake her, traveling at a height of 80 meters (—— feet). The moment is supreme. Below me is the sea, the surface disturbed by the wind, which is now freshening. Ten minutes have gone. I turn my head to see whether I am proceeding in the right direction. There is nothing to be seen, neither the *Escopette,* nor France, nor England. I am alone. For ten minutes I am lost. I touch nothing. My hands and feet rest lightly on the levers. I let the airplane take its own course. And then, 20 minutes after I have left the French coast, I see the green cliffs of Dover, and away to the west the spot where I had intended to land. I press the lever with my foot and turn easily toward the west. Now, indeed, I am in difficulties, for the wind here by the cliff is much stronger. Yet my beautiful airplane responds. I see an opening in the cliff. Once more I turn my airplane, and describing a half circle I enter the opening and find myself again over dry land. I stop my motor and instantly my machine falls straight upon the land from a height of 20 meters (—— feet). I am safe upon the shore." — Abridged

See table, page 38.

The metric system of weights and measures, which was first adopted in France in 1799, is based upon a measure called the *meter* supposed to be a ten-millionth of the distance from the equator to the poles. It is equivalent to 39.37 inches. The metric system has been adopted by nearly all the countries of Europe, and also those of South America and Mexico. It is required in certain departments of the United States government such as the Navy and the War Departments. It is the legal system of Porto Rico and the Philippines. Since it is a decimal system, reductions from one denomination in it to another may be made by moving the decimal point to the left or to the right:

Thus 2656 mm. = 265.6 cm. = 26.56 dm. = 2.656 m.

The unit of capacity is called the *liter*. The unit of weight is called the *gram*. The metric tables are formed by combining the words "meter," "gram," and "liter" with the six prefixes here shown:

Prefixes (*Latin*)	Meaning	Prefixes (*Greek*)	Meaning
milli-	.001	deka-	10
centi-	.01	hecto-	100
deci-	.1	kilo-	1000
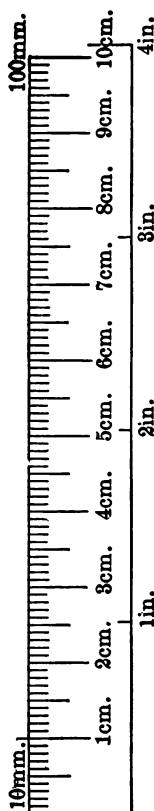
SOME METRIC UNITS EXPRESSED IN TERMS OF COMMON UNITS	
UNITS	APPROXIMATE EQUIVALENTS
1 meter	39.37 inches
1 kilometer	220 rods
1 decimeter	4 inches
1 centimeter	0.4 inches
1 liter	0.9 quart (dry)
1 hectoliter	3 bushels
1 liter	1.06 quarts (liquid)
1 gram	15.4 grains
1 kilogram	2.2 pounds

Problems.

1. Montani Brothers purchased in Naples a 200-liter cask of oil. How many gallons did they buy?

2. The tire of a French automobile has a diameter of 85 centimeters. What is its diameter in inches?

3. A St. Louis picture dealer received an oil painting from Florence. The canvas measured 1.5 meters long by 1 meter wide. What would be the inside measurements in inches for a frame?

4. M. Viviani imported from St. Etienne, France, 750 kg. of Roquefort cheese. What was its weight in pounds?

66. *Written Problems.*

1. The distance from New York to San Francisco by way of the Straits of Magellan is 13,240 nautical miles. This is $2\frac{1}{2}$ times the distance by way of Panama. How many nautical miles are saved by way of Panama?

2. A real estate dealer sold a house and lot for $2300. This was a gain of 15 % on the cost. How much had the house and lot cost?

3. Four men bought a carload of coal weighing 75,000 pounds. One man took 18 % of it, another 25 % of it and another 26 % of it. How many pounds did the fourth man take?

4. If the total cost of the load of coal described in problem 3 was $225, how much should each man pay?

5. See how many seconds it takes you to multiply 198,520 by 25 by long multiplication. See how much less time it takes to perform the multiplication by the use of aliquot parts.

6. Make out and receipt a bill for: 12 yd. cloth @ $1.50; 12 yd. lace @ $8\frac{1}{3}$¢; 16 yd. ribbon @ $12\frac{1}{2}$¢.

7. An agent for an automobile company received a commission of 6 % on his sales. In one month he sold five automobiles at $875 and two others at $1275. How much did he earn? How much did he make above his expenses of $250?

8. If $66\frac{2}{3}$ % of a certain soil is fine sand, how much sand in a load containing 27 cubic feet of soil?

9. A man bequeathed $150,000 to a college with the proviso that the interest on it at 4 % should provide for 15 annual scholarships. Find the amount of each scholarship.

10. One week an agent sold 16 vacuum cleaners at $18.50 each. His commission was 25 %. What was his income?

11. A farm was sold for $66\frac{2}{3}$ % of the cost. If the loss was $800, what was the cost?

12. If 30 % of a chicken is waste, what is the weight of the edible part of a chicken weighing 3 pounds 2 ounces?

13. A piece of beef, after roasting, weighed 15 pounds or $83\frac{1}{3}$ % of its original weight. What was its weight before roasting?

14. Henry Somers borrowed $150 of Gordon Morrison, July 10, 1918, and gave his note payable to Gordon Morrison, or order, in 90 days with interest at 5 %. How much was due Mr. Morrison when the note matured? Write the note.

15. There is 15 % of nutritive matter in walnuts. Find the amount of food in 45 pounds of walnuts.

16. The Board of School Commissioners is constructing two new school buildings. What must be the height of the school rooms to give each pupil 250 cubic feet of air? The rooms are 25 × 30 feet and will seat 40 pupils. Does your school room give this amount of air per pupil?

17. A house was sold for $2025 at a gain of $12\frac{1}{2}$ %. How much did the house cost?

18. A Chicago woman has inherited a clock bearing the date 1787 and a silver coffee urn made one hundred four years ago. Which is the older? By how many years?

19. Street Car No. 47 on the College Avenue line averages 52 passengers on each of the fifteen trips it makes a day. If on each trip twelve of these passengers pay cash fares of 6¢ each, 25 per cent of the rest have transfer tickets and the others yellow tickets (bought twenty for a dollar), what are the total receipts for a day?

20. A fruit dealer paid 25¢ a dozen for lemons. How much did he clear on 60 dozen lemons if his profit was $16\frac{2}{3}$ %? ·

21. A farmer picked 320 bushels of apples in a recent year which was 80 per cent of the quantity that he had picked the previous year. How many bushels did he pick the previous year?

67. *Pedigreed Barley.*   (For class discussion.)

The state of Wisconsin plants annually $\frac{3}{4}$ of a million or —— acres in barley. In the year 1899 this barley was like that found everywhere else — not very satisfactory in quality. Some heads would have only 2 rows of grain, others 200 % of that amount or —— rows. This second variety had only $66\frac{2}{3}$ % of the number of rows of grain found in the best heads which was —— rows. Wisconsin University determined to bring all of the barley of the state to this best quality through scientific farming.

At that time there were seven varieties of barley grown generally over the state. Exactly 3000 grains of each variety were carefully planted 4 inches apart in 10 rows, making the rows —— feet long. Each stalk was given individual attention and the best 100 stalks of each variety were put upon the honor roll. Of these 700 stalks only 140 "passed" and —— % was discarded. Fifty per cent of these selected stalks was discarded as having heads too light in weight.

The second year's course began with the planting of 100 grains from 10 heads of each of six varieties. Each variety was planted in a square by itself. The final examination of the second year consisted of selecting the best 10 % or —— heads from each bed. This process was continued for the third and fourth years. During the fourth year it was found that only $66\frac{2}{3}$ % of the six varieties being grown remained white when hulled and polished for the market. Consequently —— more varieties were discarded.

The fifth year a square rod or $\frac{1}{7}$ of an acre was sown with each of the four surviving varieties. The sixth year

there was enough seed selected from the best heads of the fifth year's crop to sow 16 square rods or $\frac{1}{?}$ of an acre. The seventh year an acre of each variety was sown and the eighth year 2000 % of this amount, or —— acres, was sown with each variety. Wisconsin University now had eighty acres planted in four varieties of barley seed.

So far the attempt had been to improve the barley in quality only. Now an effort was made to prove which of the four varieties would produce the largest yield per acre by putting a thousand acres under cultivation. The Wisconsin Agricultural Experiment Association, consisting of 1500 practical farmers, undertook the experiment at this stage. It developed that the variety known as "Wisconsin No. 55" yielded 35 bushels to the acre or $116\frac{2}{3}$ % of the amount yielded by the other varieties which was —— bushels to the acre. "Wisconsin No. 55" barley therefore became the standard barley.

When the experiment began barley was sold at 65¢ a bushel. After it had been to college for nine years it brought 200 % of its former price or $ ——. In 1911 there was enough "Wisconsin No. 55" seed to plant the $\frac{3}{4}$ of a million acres which Wisconsin devotes annually to this crop and to furnish a considerable portion of seed for the rest of the world. The increased yield of 18,000,000 bushels of barley in this state at practically an increased price of $\frac{2}{3}$ a bushel nets the state annually —— million dollars. "Wisconsin No. 55" is now known the world over as the best variety of barley.

68. *At sight:*

1. 60 is 75 % of ?	**9.** 30 is $83\frac{1}{3}$ % of ?
2. 75 % of 60 = ?	**10.** $83\frac{1}{3}$ % of 30 = ?
3. 60 is $66\frac{2}{3}$ % of ?	**11.** 40 is $62\frac{1}{2}$ % of ?
4. $66\frac{2}{3}$ % of 60 = ?	**12.** $62\frac{1}{2}$ % of 40 = ?
5. 56 is $87\frac{1}{2}$ % of ?	**13.** 36 is $16\frac{2}{3}$ % of ?
6. $87\frac{1}{2}$ % of 56 = ?	**14.** $16\frac{2}{3}$ % of 36 = ?
7. 24 is $37\frac{1}{2}$ % of ?	**15.** 24 is $8\frac{1}{3}$ % of ?
8. $37\frac{1}{2}$ % of 24 = ?	**16.** $8\frac{1}{3}$ % of 24 = ?

69. *Oral Problems.*

1. If a boy pays $2.50 a hundred for papers and sells them at 5¢ each, how much does he make on 100 papers?

2. A clerk's salary is $90 a month and her expenses 80 % of her income. What amount does she save in 3 months?

3. How many boxes each holding $\frac{1}{8}$ of a gallon will be required to hold $3\frac{1}{8}$ gallons of berries?

4. If a man can saw $\frac{7}{8}$ of a cord of wood in a day, how many cords can he saw in 9 days?

5. There were 90 passengers in a street car. Of this number $16\frac{2}{3}$ % paid a cash fare of 5 ¢ each. How much cash did the conductor receive?

6. One boy caught 15 fish, another 4 and another 6. What part of all the fish did each of the three boys catch?

7. Gerald had $2.50 and spent 1\frac{3}{4}$. How much had he left?

8. A man owning 120 acres of land sold $87\frac{1}{2}$ % of it. How many acres remained?

9. Tom has agreed to weed $\frac{3}{4}$ of the garden. When he has finished $\frac{3}{4}$ of his work, what part of the garden has he weeded?

10. If it takes $\frac{11}{12}$ of a yard of braid to bind a square mat, how long is one side of the mat? Allow one inch for fullness.

11. A grocer's boy solicited orders at 40 houses and received 23 orders. What part of his calls resulted in orders?

12. Mr. Sawyer borrowed $500 with which to buy cattle. He paid the money with 6 % interest at the end of 6 months. What amount did he pay?

13. I own four houses for which the combined rent is $200 a month. How much do I receive if the agent retains 5 % commission?

14. If a yard of ribbon costs $37\frac{1}{2}$¢, how many yards can be bought for $3?

70.* *Finding what Per Cent One Number is of Another.*

1. *For study.* Albert paid $50 for his bicycle. At the end of the year he sold it at a loss of $16. What was his per cent of loss?

Solution by Unitary Analysis	Short Method

$50 = 100 %$ or the cost. $\frac{16}{50} = \frac{8}{25} = 32 \%$
$1 = 2 %$ of the cost.
$16 = 16 × 2 \% = 32 \%$ of the cost.
       His loss was 32%

2. A clergyman's salary last year was $2000. This year it was raised to $2500. What per cent has it increased?

3. A man's salary for a year was $1800 and his expenses were $1500. What per cent of his income did he save?

4. Out of 480 votes cast at an election a certain candidate received 160 votes. What per cent of all the votes did he receive?

5. I bought apples at $2.40 a bushel and sold them at 80 cents a peck. What per cent did I gain?

6. Antonio Lobraicco sells bananas for 50 cents a dozen; they cost him 40 cents a dozen. What per cent of the cost is he making?

7. Of the 800 bushels taken from an orchard, 40 bushels were defective. What per cent of the apples were marketable?

8. A ham weighing 12 pounds when raw weighed only 8 pounds when baked. What per cent of the meat was lost during cooking?

9. A man invested $9600 in a business enterprise. At the end of the year his investment was worth $10,800. What per cent was his profit?

10. There are 6000 people in a town. Of these 1200 are school children. The school children are what per cent of the entire population?

11. What per cent of: *a.* 800 is 24? *b.* 480 is 96? *c.* 260 is 52?

71. *At sight:*

  1. *a.* 1 is what part of 4?
       $\frac{1}{3}$ is what part of 4?
       $\frac{2}{3}$ is what part of 4?

        b. $\frac{1}{3}$ is what part of 1?
           $\frac{1}{4}$ is what part of 3?
           $\frac{1}{5}$ is what part of 4?

  2. *a.* 1 is what part of 7?
       $\frac{1}{7}$ is what part of 5?
       $\frac{2}{7}$ is what part of 5?

        b. $\frac{1}{7}$ is what part of 1?
           $\frac{1}{8}$ is what part of 7?
           $\frac{1}{3}$ is what part of 7?

72. *Written Dictation.*

  1. $2 - .82 = ?$

  2. $12\frac{1}{2} \times 16 = ?$

  3. $6.6 \div .6 = ?$

  4. What is the interest on $500 for 1 yr. 6 mo. at 6 %?

  5. An article was sold for $15 at a loss of 40 %. What was the cost?

73. *Multiply:*

1. $53,964\frac{6}{7}$	**3.** $92,786\frac{3}{4}$	**5.** $64,972\frac{5}{8}$	**7.** $93,852\frac{7}{8}$
273	328	192	256
2. $78,746\frac{3}{5}$	**4.** $98,764\frac{2}{3}$	**6.** $48,764\frac{7}{9}$	**8.** $79,786\frac{5}{8}$
290	357	198	480

74. *Add:*

1. 879	**2.** 876	**3.** 996	**4.** 883	**5.** 765	**6.** 876
966	775	577	358	699	686
886	768	969	996	875	288
999	265	798	693	489	889
886	878	979	968	879	349
876	988	798	896	999	456
498	590	989	778	788	996
978	999	896	888	698	933
769	886	838	769	468	869
886	898	394	766	823	899

75.* *Taxes — Introduction.*

DO NOT SEPARATE; RETURN BOTH RECEIPTS WHEN YOU PAY							

Duplicate No. 26551   **Book No. 1, A B**   Receipt No. 309

17-A

TAXES 1916	Treasurer's Office, Indianapolis, Ind., 1917
Rate, $2.69	
Poll, $2.00	

THIS RECEIPT OF NO VALUE UNLESS STAMPED PAID

Received of_____ FELIX ANDERSON
For the FIRST_____ INSTALLMENT of State, County, Township
and City Taxes on the following described property:

DESCRIPTION	LOT	OUT. LOT	SQ. OR BL.	EXEMP-TION	PERSONAL	POLL	NET VALUATION	AMOUNT TO PAY
19-25								
Danforth & Knox	15	173			740	2	4800	75.95

1ST INSTALLMENT DELINQUENT AFTER 1ST MONDAY IN MAY.
2D INSTALLMENT DELINQUENT AFTER 1ST MONDAY IN NOVEMBER.
SEE THAT YOUR PERSONAL PROPERTY AND POLL IS PAID.

Taxpayers Should Examine Receipt and See That Descriptions Are Correct.
ED. G. SOURBIER, *County Treasurer*

Questions for Investigation and Discussion:

1. What authorities built your schoolhouse? Your courthouse? Your post office? Where was the money obtained for these improvements? Name three other public improvements built with taxes.

2. When a Commercial Club advertises a city, why does it like to mention "good schools"? Does the club do this solely for the benefit of the children? Should a man who has no children in school pay school tax? Why?

3. What is meant by "tax on real estate"? By "tax on personal property"? Name three articles that would be considered "personal property."

4. By whom is "poll tax" paid? Get Webster's definition of "poll."

5. For what purpose is the money collected from "dog tax" used? For what purpose is the money collected from automobile licenses used? To whom is it paid?

13. What is meant by "assessed value"?

14. What is the business of the tax assessor?

15. What is meant by the "rate of taxation"?

16. What is meant by the "first installment of taxes"?

17. To whom are the taxes paid?

18. What is meant by "delinquent taxes"?

19. What happens if a man does not pay his taxes?

20. Does a man who owns no real estate and rents his home really pay taxes? Why do taxes and rent increase together?

Problems in Taxes.

1. On March 15, 1917, Felix Anderson received through the mail the tax notice seen on page 46. The net or *assessed* valuation of his property given is $4800. His property had been assessed at $\frac{2}{4}$ of its full value. What was its full value?

2. The tax rate for the year 1916 was $2.69 on each $100.

a. What was the amount of Mr. Anderson's property tax?

b. What was the amount of his personal tax?

c. How did the county treasurer arrive at the amount of $74.98 as Mr. Anderson's first installment?

3. Mr. O. L. Phillips owns a farm worth $8000. It is assessed at $\frac{3}{4}$ of its value. The tax rate is $1.79 on $100. What tax does he pay?

4. Mrs. A. B. Wingate pays $250 property tax. What is the assessed value of her property if the tax rate is 2\frac{1}{2}$ on $100?

5. In a village the assessed value of the property is $200,000. The amount of property tax collected is $6000. What was the rate of taxation?

76. *Written Problems.*

1. A house was sold for $5600 at a loss of 12½ %. What was the cost?

2. What was the amount paid on a note for $5000 for 8 mo. 15 da. at 6 %?

3. The circulation of a daily newspaper has increased 25 % in 3 years and is at present 250,000. What was the circulation 3 years ago?

4. How much would it cost to excavate a cellar 15 feet wide, 18 feet long and 7 feet deep at $1.95 per cubic yard?

5. An agent bought for his firm 500 bushels of apples at $2.50 per bushel and received 5 % commission. How much money was due the agent?

6. How much interest is due me on a loan of $700 for 2 yr. 5 mo. 12 da. at 6 %?

7. A man paid 20 % of his coal bill the first month and 50 % of it the second. He had then paid $49. Find the amount of the bill.

8. I bought a farm and paid ⅓ of the price in cash. At the close of the first year I paid ⅖ of the purchase price. The two payments amounted to $31,570. What was the price of the farm?

9. Find the cost of 9 gal. 3 qt. of vinegar at 12½¢ a quart.

10. A shoe merchant sent his agent in Hartford 60 dozen pairs of shoes which he sold at an average price of $5.75 a pair. How much commission did the agent receive at 4 %?

11. A merchant pays $3655 for a stock of goods and sells them at an advance of 24 %. After deducting $280 for expenses, what is his gain?

12. Mr. A. B. Collins has property in different parts of the town assessed as follows: $600, $1580, $2175, and $2400. The tax rate is $21.50 per $1000. How much tax does he pay?

13. Mr. White has $13,500. He invests 15 % of it in stock, 33⅓ % of it in land, and 25 % in mortgages; how many dollars has he left?

14. A grocer having on hand 1200 pounds of sugar sold ⅔ of it at one time and ⅕ of the remainder at another time. What per cent of the whole remained unsold? How many pounds?

15. A boy sells a book for $1.10 and thereby loses 12 %. What did the book cost him?

16. A merchant who failed paid 60 % of his debts. To one of his creditors he paid $2160. What had been his full indebtedness to this man?

17. April 5, 1918, you buy of Hobbs and Company, Nurserymen, Bridgeport, Ohio: 3 shade trees at $1.50; ½ dozen fruit trees at $.35; 50 lb. grass seed at 12½¢. *a.* Write the letter to Hobbs and Company. *b.* Make and receipt the bill.

18. Mr. Allen borrowed $350 from Mr. Benson at 6 %. How much was due Mr. Benson at the end of 2 years, 2 months?

19. A fruit dealer sold a lot of oranges for $337.50, which allowed him a profit of 12½ %. How much did he pay for them?

In the following express the tax rate per $100:

	Assessed Valuation	*Tax to be Raised on Property*		*Assessed Valuation*	*Tax to be Raised on Property*
20.	$36,000	$900	**24.**	$17,000,000	$250,000
21.	$50,000	$1,000	**25.**	$49,000,000	$630,000
22.	$825,000	$55,000	**26.**	$45,000,000	$300,000
23.	$1,235,000	$95,000	**27.**	$107,500	$1,350

77. *At sight:*

1. $\frac{2}{3} \times \frac{6}{7}$		**4.** $\frac{7}{9} \times \frac{8}{21}$		**7.** $\frac{9}{11} \times \frac{7}{27}$	
2. $\frac{4}{5} \times \frac{10}{13}$		**5.** $\frac{5}{8} \times \frac{12}{13}$		**8.** $\frac{8}{9} \times \frac{18}{19}$	
3. $\frac{5}{7} \times \frac{8}{15}$		**6.** $\frac{6}{11} \times \frac{5}{18}$		**9.** $\frac{4}{5} \times \frac{20}{21}$	

78. *Find the net proceeds:*

   1. Principal $420.   Commission 4%.

   2. Principal $560.   Commission $12\frac{1}{2}$%.

   3. Principal $880.   Commission 5%.

   4. Principal $790.   Commission 2%.

   5. Principal $600.   Commission 3%.

   6. Principal $450.   Commission 5%.

79. *At sight:*

   1. $66\frac{2}{3}$% of 36 = ?   **6.** $37\frac{1}{2}$% of 24 = ?

   2. 25% of 48 = ?   **7.** $16\frac{2}{3}$% of 36 = ?

   3. $33\frac{1}{3}$% of 54 = ?   **8.** $12\frac{1}{2}$% of 32 = ?

   4. $62\frac{1}{2}$% of 72 = ?   **9.** $87\frac{1}{2}$% of 64 = ?

   5. $83\frac{1}{3}$% of 42 = ?   **10.** 75% of 16 = ?

80. *Subtract:*

   1. $7286\frac{1}{3}$ **3.** $3586\frac{2}{3}$ **5.** $8296\frac{3}{4}$ **7.** $2408\frac{4}{5}$
        $6978\frac{7}{8}$ $2978\frac{5}{7}$ $7789\frac{7}{9}$ $1979\frac{5}{6}$

   2. $8695\frac{2}{7}$ **4.** $6387\frac{5}{9}$ **6.** $7487\frac{5}{8}$ **8.** $9589\frac{1}{4}$
        $8598\frac{3}{8}$ $5978\frac{2}{3}$ $6798\frac{8}{9}$ $8999\frac{2}{7}$

81. *At sight:*

   1. What is 8% of 24?   **3.** 9 is what per cent of 36?
        24 is 8% of what number?   What is 9% of 36?
        8 is what per cent of 24?   36 is what per cent of 9?
        24 is what per cent of 8?   36 is 9% of what number?

   2. What is 7% of 56?   **4.** What is 6% of 18?
        56 is 7% of what number?   6 is what per cent of 18?
        7 is what per cent of 56?   18 is what per cent of 6?
        56 is what per cent of 7?   18 is 6% of what number?

82.* *Profit and Loss — Relations of Base, Rate and Percentage.*

1. *For study.*

Case I	Case II	Case III
An automobile that cost $800 was sold at a profit of 25 % of the cost. What was the gain?	An automobile was sold at a gain of $200. This was 25 % of the cost. What was the cost?	An automobile that cost $800 was sold at a gain of $200. What was the rate of gain?

Case I	Case II	Case III
100 % or c. = $800	25 % of c. = $200	$800 = 100 % or c.
1 % of c. = $8	1 % of c. = $8	$1 = $\frac{1}{8}$ % of c.
25 % of c. = $200	100 % or c. = $800	$200 = 200 × $\frac{1}{8}$ %
		= $\frac{200}{8}$ % = 25 %
The gain was $200.	The cost was $800.	The rate was 25 %.

In Profit and Loss:

The *Base* is the sum invested.

The *Rate* is the per cent of gain or loss and is always calculated on the cost unless otherwise specified.

The *Percentage* is the profit or loss.

We have above what are familiarly known as "the three cases" of percentage.

1. What is the *Base* in each case? The *Rate?* The *Percentage?*

2. In Case I, the base and rate are given to find ——.

3. In Case II, the —— and —— are given to find the base.

4. In Case III, the base and percentage are given to find ——.

Change the following problem to the other two cases and solve.

2. A farm was sold at a loss of 20 % of the cost. If the loss on an acre was $16, how much did the farm cost per acre?   Continue.

3. A carriage was bought for $280 and sold for $210. Find the loss per cent.

4. By selling coal at $6 a ton a gain of 25 % was made. How much did the coal cost?

5. A man bought a house for $6000 and later sold it at a gain of 15 %. What was the selling price?

6. What per cent is gained by selling tea at 60 cents per pound, if it cost 50 cents?

7. A furniture dealer paid $160 for a dining room set and sold it at a gain of 25 %. How much did he gain?

8. A man sold a yacht at a loss of $280 which was 14 % of the cost. What was the cost of the yacht?

9. Apples are purchased for $2.40 per bushel (60 lb.) and sold by the pound at a gain of 25 %. Find the selling price per pound.

10. Find the gain per cent on neckties bought at $1.80 per dozen and sold at 25¢ each.

11. A dry goods merchant sold flannel for 45 cents per yard. This was a gain of 12½ %. How much did the flannel cost him?

12. A horse bought for $250 was sold for $150. What was the loss per cent?

13. A horse bought for $150 was sold for $250. What was the gain per cent?

14. Make three rules:

a. Given the base and the rate, how can the percentage be found?

b. Given the percentage and the rate, how can the base be found?

c. Given the percentage and the base, how can the rate be found?

Continue this work daily until the class is thoroughly familiar with the three types of problems presented on pages 51 and 52. Make haste slowly.

83.* *Ryboldt's Installment Store — Commercial Discount.*
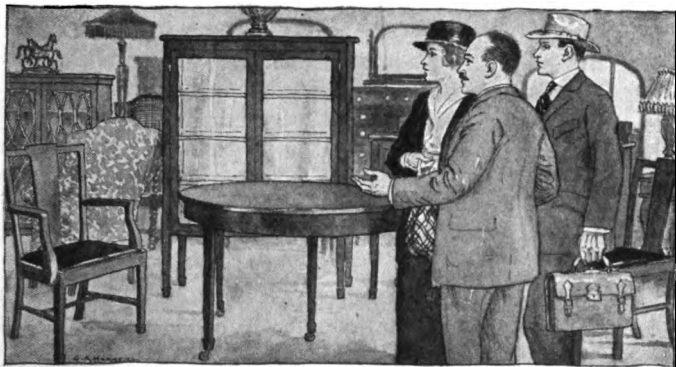
Mr. Williams: What is the price of this dining room set if bought on installments?

Proprietor: Ninety-six dollars. We require 25 % down and the rest in 12 equal installments, payable monthly.

Mrs. Williams: That would be $24 down, and $6 a month for a year.

Mr. Williams: What is your cash price?

Proprietor: We will sell for cash at a discount of 10 % on $96. That is, our cash price is $———.

Mr. Williams: By paying cash I save $9.60 and do not risk losing my furniture if I do not keep my installments paid up.

Mrs. Williams: That $9 will buy us a set of dishes.

Mr. Williams: I do not wish to be inquisitive but it seems to me that business of this kind must yield very large profits.

Proprietor: I do not mind telling you. This dining room set that you have just bought cost me $75. I make only a profit of ——— % when I sell to you for $86.40. Had I sold to you for $96 the profit would have been ——— %.

That seems an enormous per cent of gain, but suppose you had been unable to pay after you had used the set a month. I would have received in all from you $——— and you would return to me a dining room set which I could

never sell again as new. Perhaps I should have to sell it for 50 % of what it cost me. So you see, I stand the chance of losing $——.

Mrs. Williams: Yes, you would lose and so should we. By paying cash we not only lose nothing but I shall have a pretty set of dishes besides.

Proprietor: But sometimes it is a great accommodation to people who cannot pay cash. Yesterday I sold a sewing machine for $35 to a widow with three children. She paid $5 and will pay for the rest in 15 monthly installments of $—— each.

Mrs. Williams: Yes, I agree. I hope she will have no ill luck. But I have no patience with people who buy luxuries on the installment plan.

84. *Written Problems in Commercial Discount.*

1. Find the discount on a lamp listed at $12.60, $16\frac{2}{3}$ % off.

2. The regular price of a refrigerator was $25.50. If it was marked down $33\frac{1}{3}$ % for a sale, what was the selling price?

3. What is the discount on a mandolin that is listed at $30, if it is sold at 6 % off for cash?

4. The list price of a wagon is $95, from which 10 % discount is offered. Find the net price.

5. Mr. Richards bought a suit of clothes at 20 % off. If the suit was marked $29, how much did he pay for it?

6. A merchant in St. Paul bought at $62\frac{1}{2}$ % discount a carload of damaged wheat containing 925 bushels. If the original price was $1.60 per bushel, what was the total net cost?

7. Silk scarfs listed at $2.75 each are sold to a retailer at a discount of 20 %. If the retailer buys 3 dozen, how much discount does he receive?

8. At a January clearance sale all goods were marked at a discount of $33\frac{1}{3}$ % from the marked price. Give the sale price for the following articles:

| dresser $168; | chair $37.50; | bed $78; |
| davenport $216; | table $138; | couch $84. |

85. *At sight:*

1. Base $540	Rate $16\frac{2}{3}\%$	Percentage?
2. Rate $12\frac{1}{2}\%$	Percentage $24	Base?
3. Base $300	Percentage $60	Rate?
4. Percentage $75	Rate $66\frac{2}{3}\%$	Base?
5. Rate 25%	Base $960	Percentage?
6. Base $840	Rate $37\frac{1}{2}\%$	Percentage?
7. Percentage $60	Base $720	Rate?
8. Rate 20%	Percentage $150	Base?
9. Base $900	Percentage $150	Rate?
10. Rate 3%	Base $186	Percentage?

86. *Written Dictation.*

1. 12 is 6% of ?

2. 6 is what per cent of 48?

3. $25 \div .5 = ?$

4. Find the commission on $250, rate of commission 2%.

5. A merchant bought a suit for $40 and sold it at a gain of 25%. For how much did he sell it?

87. *Find the difference between:*

1. Seven million ten and nine hundred eight thousandths; and sixty-nine thousand three hundred forty-nine and nine thousand sixty-seven ten-thousandths.

2. Seventy million seven hundred thousand and seven hundred thousandths; and eight hundred eight million eight hundred and eight hundredths.

3. Three million five hundred thousand eight hundred ninety and seventy-five hundredths; and nine hundred seventy-eight thousand six hundred fifty-four and ninety-eight thousandths.

4. Three million three and three millionths; and four hundred thousand and four hundred hundred-thousandths.

Write numbers without useless ciphers.

88. *Oral Problems.*

1. At 25¢ each, how much will I pay for one dozen tubes of tooth paste?

2. How many feet of picture molding will be needed to fit a room 17 feet wide and 20 feet long?

3. A bushel of good corn makes 48 pounds of bolted meal; how many pounds of meal will $6\frac{1}{2}$ bushels make?

4. A wagon with its load of corn weighs 3456 pounds. The wagon alone weighs 1229 pounds; what is the weight of the corn?

5. At $$\frac{2}{5}$ a yard, what will 15 yards of percale cost?

6. If $\frac{5}{8}$ of a yard of novelty velvet costs $10, what does one yard cost?

7. In a certain school there are 15 girls and 120 % as many boys. How many boys are there in the school?

8. One basket holds $\frac{1}{3}$ of a bushel of peaches. How many bushels will 18 baskets hold? How many baskets will hold 18 bushels?

9. 15 is $\frac{3}{7}$ of what number? What is $\frac{9}{7}$ of the same number?

10. A man owned 60 acres of land and sold 10 acres. What per cent of his farm did he sell?

11. Fred has $30 in the bank. Pauline has $16\frac{2}{3}$ % as much. How much have both?

12. Sold a cow for $12 more than she cost, which was a gain of 20 % upon the cost. What was the selling price?

13. James spelled 96 words correctly in the examination. Arthur spelled 75 % as many and Edward spelled 75 % as many as Arthur. How many words did Edward spell?

14. An agent collected $210 for me at a commission of 10 %. What was his commission? How much money did I receive?

15. 20 % of a certain sum of money is $4.90. What is the sum of money?

16. Mr. A owned a farm of 120 acres. He sold 60% of his farm. How many acres remained?

17. Mr. B owned a farm of 120 acres which was 60% of the number of acres in his neighbor's farm. How many acres did the neighbor own?

18. Mr. C owned a farm of 120 acres. He sold 40 acres. What per cent of his farm did he have left?

19. I had $60 in the bank. I deposited $25.50 and later withdrew $20.75. How much then remained?

20. Elizabeth is 12 years old. Her age is respectively 50%, 33⅓%, and 25% of her aunt's age, her mother's age, and her father's age. How old is each relative?

21. What discovery do you make in the foregoing problem? The larger the per cent the —— the answer.

22. A man owned 72 cows and sold 9. What per cent of his herd did he have left?

23. At $1¾ each, how many felt hats can be bought for $8¾?

24. A florist has 4 dozen American Beauty roses. This is 60% of all his roses. How many roses has he?

25. The tail on Jack's kite was 8 yards long. What per cent of it did he lose when 8 feet broke off?

26. A cook uses 8½ pounds of flour a day. How much will she use in 30 days?

27. Lora has finished 2¾ yards of hemming and her sister 4⅔ yards. How much have the two girls done?

28. 24 inches is what per cent of a yard?

29. In a farm of 40 acres, 25 acres are in fruit trees. What per cent of the farm is in fruit?

30. What is the interest on $900 for one month at 6%?

89.* *Marking Goods — Discount.*

See previous lesson, pp. 53, 54.

Merchants frequently give a discount to customers for a quick sale of goods which have lasted over the season. It is customary to attach a tag to each article bearing a private mark which enables the clerk to know how great a discount may be made without selling goods below cost. One of the methods employed for this purpose is to select a word or words containing ten different letters, like *brick ovens*, which may be taken as the key, thus

$$
\begin{array}{cccccccccc}
b & r & i & c & k & o & v & e & n & s \\
1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 0
\end{array}
$$

To make it more difficult to detect the key, some letter, say *d*, is used when a digit is repeated in a number. We call *d* the repeater. For example, an article which cost $1.65 is to be marked $1.99. The tag would show the cost above the line and the marked or asking price below: $\frac{BOK}{BND}$. The clerk on reading this tag would know that he could safely give a discount of 10 % or even 15 % from the marked price and still sell above cost, but that 20 % would be prohibitive. In many stores the selling price is written plainly in figures and only the cost price is reserved.

Written Problems (using *brick ovens* for marker with letter *d* for repeater).

1. Goods are marked $\frac{CRS}{CKS}$. If sold at the marked price, what is the per cent of gain?

2. Goods marked $\frac{VRS}{CSD}$ were sold at a discount of 10 %. What was the profit?

3. If the marked price is marked EDS and the profit is 80 cents, what is the cost and the rate of profit?

4. The cost of an article is $4.80. It was marked at $6.40 and sold at a discount of 10 %. What was gained on the article?

90. *At sight:*

1. $87\frac{1}{2}$ % of 16 is $66\frac{2}{3}$ % of ?
2. $62\frac{1}{2}$ % of 56 is 50 % of ?
3. 75 % of 28 is $33\frac{1}{3}$ % of ?
4. $37\frac{1}{2}$ % of 32 is $16\frac{2}{3}$ % of ?
5. $66\frac{2}{3}$ % of 9 is $37\frac{1}{2}$ % of ?
6. $33\frac{1}{3}$ % of 36 is 75 % of ?
7. 50 % of 72 is 90 % of ?

8. $83\frac{1}{3}$ % of 18 is 25 % of ?
9. $12\frac{1}{2}$ % of 56 is $87\frac{1}{2}$ % of ?
10. $16\frac{2}{3}$ % of 54 is $37\frac{1}{2}$ % of ?
11. $62\frac{1}{2}$ % of 40 is $33\frac{1}{3}$ % of ?
12. $66\frac{2}{3}$ % of 24 is 25 % of ?
13. 60 % of 80 is 75 % of ?
14. 80 % of 90 is 150 % of ?

91. *Find the interest on:*

1. $895 for 4 mo. at 4 %.
2. $630 for 10 mo. at 5 %.
3. $675 for 8 mo. at 6 %.
4. $795 for 7 mo. at 5 %.
5. $705 for 3 mo. at 3 %.

6. $486 for 6 mo. at 6 %.
7. $185 for 5 mo. at 7 %.
8. $875 for 2 mo. at 4 %.
9. $475 for 2 mo. at 6 %.
10. $360 for 6 mo. at 5 %.

92. *Multiply:*

1. 7964 by 9.706
2. 54.09 by 407.9
3. 9078.7 by 907
4. 9647.8 by 89

5. 7694 by 7.008
6. 5698.7 by .0097
7. 7856.4 by 9400
8. 6.009 by .0078

93. *Add:*

1.	2.	3.	4.	5.	6.
967	785	568	734	757	899
698	879	965	759	877	699
389	654	699	546	878	348
777	976	888	899	587	678
486	468	975	999	988	247
877	899	967	867	577	959
798	688	477	963	899	768
596	386	869	985	965	987
396	782	969	896	669	888
689	876	854	897	989	479

94. *Written Problems.*

1. The tax to be raised in a certain town is $30,000. There are 500 polls, that is, 500 male citizens over 21. What must be raised by a property tax if the poll tax is $2 each?

2. Codfish bought at $18 per hundredweight was sold in 10-pound boxes at $2.10 per box. Find the gain per cent.

3. If 36 % of the people in a certain city are voters and there are 9000 voters, what is the population of the city?

4. My agent collects the yearly rent of my house and retains $15, the amount of his commission at 2½ %. How much does he pay me per year?

5. A firm announced that the wages of the men in their factory were to be raised 20 % after January 1. What is the increase in the pay roll for 25 men who were getting $5.75 per day before the raise?

6. When 20 lb. of green tea are mixed with 30 lb. of black tea, what per cent of the mixture is black tea and what per cent is green tea?

7. Mr. Brown sold his piano for $400. This was a loss of 20 %. How much did it cost him?

8. How many rolls of plain paper will it take to paper the walls of a room 18 feet by 15 feet and 9 feet high, if no allowances are made?

Wall paper is sold in single rolls 8 yards long or in double rolls 16 yards long. It is usually 18 inches wide. Fractional parts of a roll are not sold.

9. The rate of commission for selling land is 4 % on the first $2000, 3 % on the third $1000 and 2 % on each additional $1000. If a man sold 80 acres at $75 per acre, what would be the proceeds from the sale?

10. A merchant who shipped 200 crates of eggs lost 25 crates by freezing. What per cent of the eggs was received in good order?

11. A piece of property was sold for $3600. This was a gain of 20%. Find the cost.

12. Write a letter ordering from A. P. Bonham and Company, Wholesale Grocers, the following:

> 1 dozen cans tomato soup at $1.80
> 1 dozen cans fancy corn at $2.16
> 1 dozen cans June peas at $2.40

13. Imagine yourself the shipping clerk of A. P. Bonham and Company. Write the necessary letter and inclose the bill. Make a discount of 10%.

14. The Red Cross fund in a certain city amounted to $100,000. The Jefferson school in that city raised $500 of the amount. What per cent of the fund did it raise?

15. How much less will it cost at $2.60 per rod to fence a field 60 rods square than to fence a rectangular field twice as long and $\frac{1}{2}$ as wide?

16. A physician charges $2 per visit and makes an average of 10 visits per day for 300 days in the year. He collects 55% of his charges. How much does he collect?

17. I promised to pay on demand a note for $460 with 5% interest. At the expiration of 2 yr. 4 mo., the interest and the principal were paid. What was the amount.

18. 12 is what fractional part of 96? 96 is what per cent of 12?

19. From a barrel containing 60 gallons of vinegar, .625 gallons were drawn out at one time, $14\frac{1}{2}$ gallons at another, and .85 gallons at another. How many gallons then remained in the barrel?

20. The President of the United States receives $75,000 a year. How much does he receive a day?

21. Last fall a woman bought a flock of 20 sheep for $160. This May she sold 16 lambs at $5 and the wool from the original flock, averaging 9 pounds to the sheep, at $33\frac{1}{3}$¢ a pound. What per cent has she realized on her investment if their care during the winter cost $50?

18 ft.

6 ft.

3 ft.

6 ft.

6 ft.
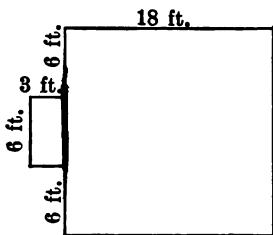
22. The Foster Munger Company of Cleveland advertises wood carpet in oak, cherry and maple at 32¢ a square foot. Write a letter ordering the quantity required to cover a floor the size indicated by the accompanying cut. State kind of wood desired and that the amount named on the enclosed money order is for payment.

23. The quotient is 8057.69 and the divisor 8.09. What is the dividend?

24. One bushel of wheat is what per cent of a peck? One half of a mile is what per cent of 8 miles?

25. A lawyer collected 95 % of a debt of $7846 and charged 5 % of the sum collected. How much money was the lawyer paid for his work?

26. Make out a bill of the following sale and receipt it. Use your teacher's name as buyer and the name of some store in the city as seller: 12 yards of China silk at $1.25; $1\frac{1}{2}$ yards velvet at $2.25; $\frac{1}{2}$ dozen handkerchiefs at $.25; and an umbrella for $2.50.

27. The four elevators in the Stevenson Building run every 2 minutes from 7 A.M. until 11:15 P.M. If 600 persons ride before 8 o'clock and 2100 after 5 o'clock, then 70 % have ridden between those hours. What is the total number of passengers in an average day?

28. A new city addition contains 120 acres. If 3200 square rods are taken by a stream, streets and alleys, what part of the ground remains to be divided into building lots?

Test Page I

This page and the one following contain types of exercises which the
class should do readily before proceeding to Part I, Section Two. A
class percentage of not less than eighty should be required.

I

Write answers only:

1. 12 is what per cent of 18?

2. 2.4 ÷ 6 = ?

3. Find the interest on $400 at 6 % for 3 months.

4. Mr. Woodward sold his lot at a gain of $400. If this
was 40 % of the cost, what had the lot cost him?

5. Mr. Hicks's sales one week amounted to $480. If his
commission was $12\frac{1}{2}$ %, how much was his commission for
the week?

II

Show all work — time limit 25 minutes:

1. I employed a lawyer to collect a debt of $4800. He
succeeded in collecting $87\frac{1}{2}$ % of it. If his commission was
5 %, how much did I receive?

2. Mr. Black borrowed $2500 from Mr. Burton at 6 %.
What was the amount of his debt at the end of 2 years,
5 months, 12 days?

3. A merchant is forced to sell damaged articles at a loss
of $37\frac{1}{2}$ %. What was the cost of an article which he sells
for $17.50?

4. If the tax is $18 on every thousand dollars of the
valuation of my property, how large will my tax be if I am
assessed for $5000?

5. A slightly used dining room set was sold for $75. This
was a discount of $25. What was the rate of discount?

Test Page II

III

Oral Problems

Before solving, name the operation to be used.

1. How much tax did a man pay on $350 worth of personal property at $2.50 on $100?

2. An agent sold a house for $5600 at 5 % commission. What was his commission?

3. By selling corn at $1.40 a bushel, I lost $12\frac{1}{2}$ %. Find the cost.

4. In $2\frac{2}{3}$ acres, how many lots containing $\frac{2}{3}$ of an acre each?

5. In a farm of 36 acres there are 27 acres planted in wheat. What per cent of the farm is planted in wheat?

IV

Write at dictation:

1. *Add:* 56.9 + 986.88 + 9.717 + 562.2 + 49.49 + 5.987 + 476.69 (two minutes).

2. Find the difference between: 7700.707 and .000007 (one minute).

3. Multiply 8764.973 by .0908 (three minutes).

4. Divide 233,823 by 28.9 (three minutes).

5. Multiply 5264 by $294\frac{3}{5}$ (two minutes).

V

Each child one exercise (oral):

1. $66\frac{2}{3}$ % of 42 = ?
   12 is 4 % of ?
   14 is what % of 21?
Base $150, Percentage $50, Rate?

2. 28 is 7 % of ?
   18 is what % of 45?
   $87\frac{1}{2}$ % of 24 = ?
Rate, $12\frac{1}{2}$ %, Percentage $20, Base?

3. 6 is what % of 48?
   42 is 6 % of ?
   $83\frac{1}{3}$ % of 54 = ?
Percentage $30, Base $180, Rate?

4. 72 is what % of 96?
   48 is 80 % of ?
   $33\frac{1}{3}$ % of 84 = ?
Base $200, Rate 5 %, Percentage?

PART I — SECTION TWO

1. *Baseball.*
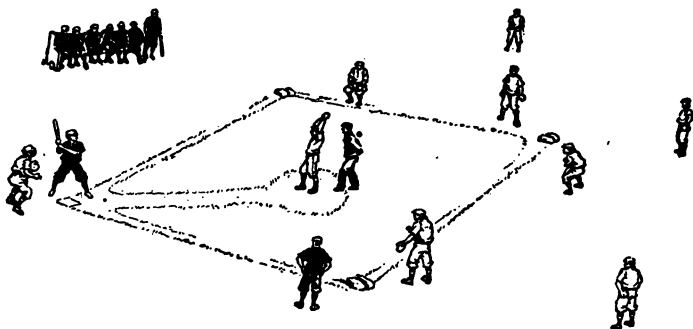
1. Using a scale of 1 inch to represent 30 feet, draw a baseball diamond or infield 90 feet each way. Designate the four corners as home, first, second and third bases respectively. Draw a diagonal from home to second base. On this diagonal place a small cross approximately 60.5 feet from home and designate it as the pitcher's plate. Extend the diagonal 10 feet beyond home and make a second cross at the end. Designate this as the catcher's plate. Where does the batter stand? The center-fielder?

2. After playing the first 8 games of the season, the Cherry Hill Club had won 5 games and lost 3. State the standing of the club as a common fraction and as a per cent.

3. A baseball team won 16 games during a season, which was 64 % of the total number of games played. How many games did it lose?

4. In one club a short-stop made 18 errors out of a total of 450 plays. In a rival club the short-stop made 24 errors in a total of 480 plays. Which had the better standing?

5. The center-fielder threw a ball 90 feet. This was $12\frac{1}{2}\%$ farther than the third baseman had thrown the ball. How many feet farther did the center-fielder throw the ball than the third baseman?

6. The daily paper reported that the percentage of victories for a certain club was .748 because they had won practically $\frac{3}{4}$ of the number of games they had played. Correct the error.

7. In one season 1150 batsmen faced a pitcher. A total of 286 base hits was made by the batsmen. What was the per cent of hits to times at bat?

8. If Daubert was at bat during the season 504 times and made 284 hits, what was his batting percentage? If he made 76 runs, what was his per cent of runs to hits?

9. At the end of one season, the clubs in the Pacific Coast League stood as follows:

	Won	*Lost*	
Portland.	109	86	
Sacramento.	103	94	What per cent of the
Venice.	107	102	games played was
San Francisco.	104	103	won by each club?
Los Angeles.	100	108	
Oakland.	90	120	

2.* *Dividing a Mixed Number by an Integer.*

1. *For Study.*
$29\frac{2}{3} \div 4 = ?$
$29 \div 4 = 7$, rem. 1
$1\frac{2}{3} \div 4 = \frac{5}{12}$
$29\frac{2}{3} \div 4 = 7\frac{5}{12}$

2. $37\frac{3}{4} \div 5$

3. $76\frac{3}{5} \div 8$

4. $84\frac{5}{6} \div 9$

5. $71\frac{7}{8} \div 6$

6. $43\frac{5}{7} \div 7$

Read the Preface, the Table of Contents and Suggestions to Teachers. Lessons marked * should be assigned for study previous to the recitation.

3.* *The Precedence of Arithmetical Signs.*

In all computations, multiplications and divisions should be made before additions and subtractions because multiplication and division signs indicate factors of one number, while addition and subtraction signs connect different numbers. For example:

Correct	Incorrect
$30 + 2 \times 50 =$	If the order of the signs had been followed
$30 + 100 = 130.$	the result would have been:
	$32 \times 50 = 1600.$

1. $90 - (20 \times 4) = ?$
2. $5 + (30 \div 6) = ?$
3. $40 - (8 \times 5) = ?$
4. $8 + (2 \times \frac{3}{4}) = ?$
5. $12 - (4 \div \frac{5}{6}) = ?$
6. $(8 \times 3) + (5 \times 6) = ?$
7. $6 + (9 \div 3 \times 20) = ?$
8. $12 - 5 + (14 \div 2) = ?$
9. $7 \times 4 + 6 \times 7 = ?$

10. $15 - 2 \times 3 + 7 = ?$
11. $21 + 5 - 4 \times 3 = ?$
12. $5 + 16 - 4 \times 2 = ?$
13. $19 - 6 + 5 \times \frac{3}{4} = ?$
14. $25 + 64 \div 4 - 9 = ?$
15. $9 + 7 \times 3 - 15 = ?$
16. $15 \div 3 + 27 \div 3 = ?$
17. $7 + 5 \times 6 \div 2 = ?$
18. $8 + 4 + 4 \times 3 = ?$

4. *Give results at sight:*

1. $1\frac{1}{3} + 2\frac{5}{6}$
2. $\frac{1}{10} \div \frac{3}{5}$
3. $\frac{5}{6} - \frac{1}{2}$
4. $\frac{5}{7} \times \frac{1}{2}$
5. $\frac{1}{3} + \frac{2}{9}$
6. $\frac{3}{8} \times \frac{4}{9}$
7. $\frac{2}{5} \div 3$
8. $\frac{2}{3} - \frac{2}{7}$

9. $\frac{7}{8} - \frac{1}{4}$
10. $2\frac{1}{5} \times 4$
11. $\frac{3}{5} \div \frac{1}{10}$
12. $1\frac{7}{8} + 2\frac{1}{4}$
13. $1\frac{1}{2} - \frac{2}{5}$
14. $\frac{1}{2} \times \frac{2}{3}$
15. $\frac{8}{9} \div 9$
16. $2\frac{3}{8} + 1\frac{1}{2}$

17. $\frac{1}{2} \div \frac{1}{3}$
18. $2\frac{1}{3} + 1\frac{3}{4}$
19. $\frac{3}{4} \times \frac{2}{3}$
20. $\frac{1}{3} - \frac{2}{9}$
21. $2\frac{1}{2} + \frac{3}{4}$
22. $\frac{3}{5} \times \frac{2}{7}$
23. $\frac{5}{13} \div 4$
24. $1\frac{1}{8} - \frac{2}{3}$

5. *Oral Problems.*

1. A player piano that cost $960 was sold for $1080. What was the per cent of gain?

2. At 33⅓¢ per sq. ft., what will a piece of slate board 4 ft. by 6 ft. cost?

3. What is the interest on $200 for 1 yr. 6 mo. at 6 %?

4. A dealer buys pails at $3 per dozen and sells them at a profit of 20 %. What is his price per pail?

5. What is the cost of 60 lb. of bran at $1.10 per hundred?

6. A boy works for the District Messenger Company from 4 P.M. to 8 P.M. every day (Sundays included), at 20 cents per hour. How much did he earn during the month of November?

7. A real estate dealer bought a lot for $800 and built a house costing $2000. He immediately sold the house and lot for $3500. What was the per cent of gain?

8. What is the interest on $200 at 6 % for 1 yr. 4 mo.?

9. What is 33⅓ % of $2100?

10. To 20 gallons of paint add 5 gallons of turpentine; the paint is what per cent of the mixture?

11. I paid the price of a pound for 13 oz. What part of the cost did I lose?

12. Allowing ¾ of a foot for the length of a brick and its mortar, how many bricks in a wall that is 6 feet long?

13. John spends ¼ of the time studying and ⅓ of the time sleeping. What part of each day remains for other things?

14. Grandfather said, "The river is now 6.8 feet higher than it was during the last flood." If the river is 11.7 feet above the low water mark, how high was it at the time grandfather remembered?

6.* *Finding the Value of a Part when that of the Whole is Given — Profit and Loss.*

Preliminary Questions.

a. When an article is sold at cost, the selling price is what per cent of the cost?

b. When an article is sold at a gain of 20 %, the selling price is what per cent of the cost? What fractional part? What decimal part?

c. When an article is sold at a loss of 25 %, the selling price is what per cent of the cost? What fractional part? What decimal part? Continue.

1. *For study.* A city lot which cost \$800 was sold at a gain of 20 %. What was the selling price?

Unitary Analysis	Short Methods
1 % of c. = \$800 ÷ 100 = \$8	120 % = $\frac{6}{5}$ or 1.2
120 % of c. = 120 × \$8 = \$960 s.p.	I. Common Fractions $\frac{6}{5}$ × \$800 = \$960
	II. Decimal Fractions 1.2 × \$800 = \$960

The selling price was \$960.

Solve by both common fractions and decimals — short methods — the following:

2. A quantity of leather that cost \$824 was sold at a gain of 12½ %. For how much was it sold?

3. Some goods that cost \$560 were sold at a loss of 12½ %. What was the selling price?

4. A farm costing \$8800 was sold at a gain of 18 %. For how much did the farm sell?

5. A man had a library containing 2000 volumes. He lost 27 % of the books by fire. How many books remained?

6. A town which had 3200 inhabitants increased 6¼ % of the population in one year. What was the population at the beginning of the second year?

7. 800 pairs of children's shoes cost \$1600. What price must be put on each pair to make a profit of 45 %?

7. *Written Problems.*   Short method where possible

1. A furniture dealer sold to one man $250 worth of furniture, allowing him 10 % off for cash. How much was received for the furniture?

2. Find the cost of plastering the walls and ceiling of a hall 32 feet long, 10 feet wide and 9 feet high at 50¢ a square yard.

3. An agent collected 76 % of a debt of $3250 and charged 7 % commission on the sum collected. How much did the creditor receive?

4. From 7.7 take 77 hundredths; divide the remainder by 3 hundredths; multiply the quotient by one thousandth; to the product add 50; multiply the sum by 10.

5. A train that was running 40 miles an hour increased its speed 12½ %. How long would it take to make a trip of 225 miles after increasing its speed?

6.† If .875 acre of land is worth $1050, what is the value of ⅝ of an acre? Ratio.

7. An electric toaster listed at $9.60 was sold at 16⅔ % off. Find the selling price.

8. The wheel of a carriage is 14⅘ feet in circumference. How many revolutions does it make in going a quarter of a mile?

9. If in a certain town 4375 of the 25,000 inhabitants are miners, what per cent of the population are miners?

10. A contractor bought 24,500 bricks for $294; what was the price per M?

11. How much will 640 bags of coffee, each weighing 132 pounds, weigh when roasted, if coffee loses 16⅔ % of its weight in roasting?

12. Draw a line *AB* 2 inches in length. Draw a line *CD* intersecting the line *AB* at right angles. Mark the point of intersection *E*. How many degrees in the angle *AEC?*

13. Find the gain per cent on a gross of brooms bought for $86.40 and sold at $.75 each.

† See Table of Contents.

14. The dimensions of a lot are 80×100 feet. The four-room house occupies 60×80 feet of this space. Make a drawing showing the size of the lot and of the house, allowing $\frac{1}{2}$ inch to represent 10 feet. The house occupies what per cent of the lot? Drawing.

15. A woman furnished her dining room with a table for $29.50, 6 dining room chairs at $4.25 each, and a buffet for $37.50. She was allowed 10 % off for cash. How much did her furniture cost?

16. What is $\frac{5}{8}$ of a farm worth if the rest of it sells for $2700?

17. A teacher gave her pupils 24 pounds of plastina for use in modeling. The pupils used $62\frac{1}{2}$ % of it. What was the weight of the unused portion?

18. The road from my farm to the nearest railroad station runs 3 miles east, $1\frac{1}{2}$ miles north, $\frac{3}{4}$ of a mile northeast. In a scale drawing, the 3-mile part is represented by 16 inches. How long a line will represent each of the other parts of the road? Drawing.

19. A book cost the dealer $4. He sold it at a gain of 35 %. What was the selling price?

20. A family spends in one month $58.50 for groceries, $8.50 for fuel and lights and $25 for rent. If the income is $150 per month, what per cent is spent for living expenses?

21. A dealer bought 50 boxes of oranges each containing one gross. He found that 5 % were decayed. How many good oranges did he buy?

22. I bought of my grocer on Saturday May 3, 1919, 1 pound of bacon at 55¢, $1\frac{1}{2}$ pounds of butter at 50¢, 1 dozen eggs at 48¢, 2 loaves of bread at 10¢, $\frac{1}{2}$ dozen oranges at 30¢, and 2 pounds of rice at $17\frac{1}{2}$¢. I gave the clerk a $10 bill in payment. Make and receipt the bill and state the amount of change I should receive.

8. *Give results:*

1. $35 + (14 \div 7) - 9 = ?$
2. $27 - 15 + (18 \div 3) = ?$
3. $(56 \div 7) + (24 \times 2) = ?$
4. $39 + 6 - (25 \div 5) = ?$
5. $(81 \div 9) - (24 \div 6) = ?$

6. $24 + 9 - (27 \div 3) = ?$
7. $92 - (12 \times 3 \div 4) = ?$
8. $82 + (18 \div 6) - 77 = ?$
9. $45 \div 9 + 7 + 23 = ?$
10. $(11 \times 7) + 14 - 49 = ?$

9. *Express results as compound denominate numbers:*

1. 60% of 75 pints.
2. 25% of 276 quarts.
3. $12\frac{1}{2}\%$ of 1232 sq. rd.
4. $62\frac{1}{2}\%$ of 464 ounces.
5. $66\frac{2}{3}\%$ of 453 inches.

6. $33\frac{1}{3}\%$ of 54 days.
7. $16\frac{2}{3}\%$ of 90420 rods.
8. $83\frac{1}{3}\%$ of 240 weeks.
9. 75% of 368 sq. ft.
10. $37\frac{1}{2}\%$ of 352 quarts.

10. *Reduce to lowest terms:*

1. $\frac{51}{60}$
2. $\frac{32}{96}$
3. $\frac{48}{86}$
4. $\frac{15}{80}$
5. $\frac{96}{144}$
6. $\frac{49}{84}$
7. $\frac{54}{81}$
8. $\frac{19}{57}$
9. $\frac{60}{108}$
10. $\frac{21}{63}$
11. $\frac{72}{96}$
12. $\frac{30}{72}$
13. $\frac{48}{144}$
14. $\frac{72}{144}$
15. $\frac{45}{81}$
16. $\frac{21}{91}$

11. *Find the change from $1:*

1. 56¢
2. 45¢
3. 89¢
4. 63¢
5. 48¢
6. 62¢
7. 26¢
8. 77¢
9. 79¢
10. 82¢
11. 24¢
12. 68¢
13. 16¢
14. 23¢
15. 36¢
16. 55¢
17. 38¢
18. 29¢
19. 54¢
20. 46¢

12. *Find the interest on:*

1. $1350 at 4% for 9 mo. 15 da.
2. $1400 at 6% for 2 yr. 6 mo. 10 da.
3. $6500 at 5% for 3 yr. 4 mo. 20 da.
4. $1240 at 4% for 1 yr. 9 mo. 16 da.
5. $1780 at 5% for 3 yr. 1 mo. 5 da.

13.† *American Baseball Association for* 1919.

1. How many clubs in the Association?

2. Which won the annual championship?

3. Contrast the record of Minneapolis and Louisville.

4. Why did not Columbus get a higher place?

5. Which two clubs tied?

6. Compare Milwaukee and Toledo.

7. Standing of clubs at the close of the season:
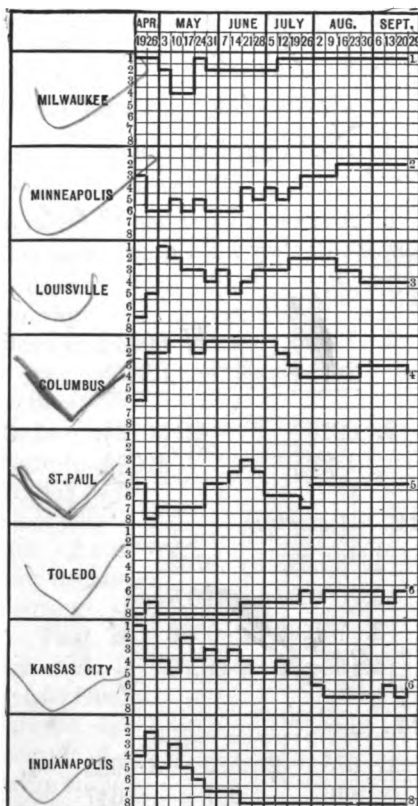
Club	Won	Lost	%	Club	Won	Lost	%
Milwaukee...	100	67	?	St. Paul.....	77	90	?
Minneapolis..	97	70	?	Kansas City..	69	98	?
Louisville....	95	72	?	Toledo......	69	98	?
Columbus ...	93	74	?	Indianapolis..	68	99	?

† See Table of Contents.

14. *Written Dictation.*

1. $87\frac{1}{2}\%$ of 24 is $33\frac{1}{3}\%$ of ?

2. $\frac{2}{7} = \frac{?}{49}$

3. Find the interest on \$600 at 6 % for 20 days.

4. If one yard of ribbon cost \$$\frac{2}{5}$, what will $\frac{3}{4}$ of a yard cost?

5. A street vender has $1\frac{3}{4}$ pecks of chestnuts. How many times will they fill a quart measure?

15. *Subtract:*

1. $7210\frac{2}{7}$ **3.** $8043\frac{3}{8}$ **5.** $6212\frac{2}{5}$ **7.** $5104\frac{4}{7}$
     $2679\frac{3}{5}$ $6847\frac{4}{7}$ $5678\frac{5}{6}$ $3975\frac{5}{6}$

2. $6213\frac{3}{5}$ **4.** $5072\frac{1}{7}$ **6.** $4210\frac{2}{5}$ **8.** $6123\frac{3}{8}$
     $4598\frac{7}{9}$ $4298\frac{4}{9}$ $3178\frac{3}{4}$ $4965\frac{5}{6}$

16. *Multiply:*

1. 85.398 by .0709   **5.** 690.45 by 98.06

2. 698.07 by 790.8   **6.** 635.08 by 70.69

3. 709.68 by .0086   **7.** 496.87 by 970.6

4. 654.37 by 98.76   **8.** 782.986 by .97

17. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
585	586	988	580	687	989
846	687	647	295	793	589
798	777	589	782	667	779
858	988	994	661	782	788
769	955	878	648	959	598
657	587	265	296	396	955
679	699	583	802	547	399
995	245	342	690	878	787
349	477	647	295	959	908
988	699	324	735	764	679

18.* *The Circle and the Right Angle.*

When the ancients discovered that the earth made a complete revolution about the sun in one year, it was thought that the year contained exactly 360 days, and that the earth completed $\frac{1}{360}$ of its journey each day. For this reason the earth's path around the sun (which was supposed to be circular) was divided into 360 parts called *degrees*. Later two mistakes in this calculation were found. The year contains exactly $365\frac{1}{4}$ days and the path about the sun is elliptical. However, the division of this great circle into 360 degrees became the standard for measuring all circles great and small. That is, the circumference of every circle is said to contain 360° (degrees). Would there be a difference between the length of a degree in a small circle and one in a large circle? Examine the four concentric circles

a, *b*, *c*, *d*. The circumference of each of these contains 360°. The diameters drawn cut each of these into four equal parts or sectors each containing 90°.

> The circumference of every circle is divided into 360 equal parts called degrees (°). Every degree is divided into 60 equal parts called minutes (′) and every minute is divided into 60 equal parts called seconds (″).

a. North Pole.   c. Tropic of Cancer.
b. Arctic Circle.   d. Equator.

This lesson should be illustrated by a large globe.

1. In what direction does the earth rotate on its axis? How long is it in making one revolution?

2. In the revolution of the earth, which will travel faster, a man living on the Equator or one living on the Arctic Circle? Explain why.

3. The circumference of the earth at the Equator is approximately 25,000 miles. How many miles in one degree of longitude at the Equator?

4. Through how many degrees does any point on the Equator pass in one hour? Any point on the Tropic of Cancer? On the Arctic Circle?

5. The earth revolves 15° in one hour. Hence for each 15° there is a difference of one hour in the time of sunrise. San Francisco is about 50° west of New York. In which city does the sun rise the earlier? Continue.

In computing longitude it is necessary to fix upon some place from which to start. You will find that all of our maps use Greenwich for the starting place. This is because England, the greatest seafaring nation, has an observatory

there and all other nations have tended to measure from that place.

6. In the map above and on the globe find the meridian of Greenwich. Find also the meridian marked 180°. Find the meridians 90° East and 90° West.

When two diameters divide the circumference of a circle into four equal parts they are *perpendicular* to each other. The four equal angles at the center are called *right angles*.

Make sure that pupils learn how to erect a perpendicular by use of the compass.

7. How many degrees in a right angle?

8. Draw an oblong or square, using *a c b* for one corner. Why is such a figure called a rectangle?

19.* *Relation between the Cost and Gain or Loss.*

See previous lesson, p. 69.

1. *For study.*

a. A city lot which cost $800 was sold at a gain of 20%. How much was the gain?

b. A city lot was sold at a gain of $160, which was 20% of the cost. What was the cost of the lot?

Solution (Short method)
I. $\frac{1}{5}$ × $800 c. = $160 g.
II. .20 × $800 c. = $160 g.
The gain was $160.

Solution (Short method)
I. $160 g. ÷ $\frac{1}{5}$ = $800 c.
II. $160 g. ÷ .20 = $800 c.
The cost was $800.

Pupils should recognize in *b* that we have a short method for "Finding the Value of the Whole when that of a Part is Given." The previous lessons have given ample preparation for this, the most difficult step in percentage. See page 32. Make sure the class understands the reason for dividing by $\frac{1}{5}$ (or .20) and then insist upon solution by the short method.

2. Some goods that were damaged by fire were sold at a loss of $\frac{3}{8}$ of the cost, or $180. What was the cost?

3. The gain on a sale of machinery was $257.70, which was $\frac{1}{3}$ of the cost. Find the cost.

4. Find the cost per dozen pairs of infants' woolen hose on which the gain is 10¢ or $\frac{2}{5}$ of the cost per pair.

5. Some goods that cost $6000 were damaged by fire and sold at a loss of 40%. How much was lost? Give the corresponding problem under Case II.

Find the Cost and Selling Price:

	Rate	Loss		Rate	Gain
6.	5%	$185	**11.**	22%	$660
7.	17%	$510	**12.**	18%	$720
8.	42%	$1260	**13.**	23%	$920
9.	13%	$3900	**14.**	15%	$180
10.	26%	$7800	**15.**	41%	$205

20. *Oral Problems.*

1. Three strips of ribbon $2\frac{1}{4}$ inches wide are sewed lengthwise. How wide is the strip?

2. An island is 11 miles in circumference. Two yachts sail around it, starting from the same place and going in opposite directions. The first goes at the rate of 3 miles an hour and the second at the rate of $2\frac{1}{2}$ miles an hour. In how many hours do they meet?

3. If a man goes .75 of a mile in 6 minutes on his wheel, how long will it take him to go a mile?

4. A lady owed a grocer $$\frac{3}{5}$ and gave him $$\frac{3}{4}$. What change did she receive? What part of a dollar?

5. A house was bought for $5000 and sold at an advance of $\frac{1}{4}$ over the cost. For how much was it sold?

6. When canned tomatoes are advanced from 15 cents to 18 cents per can, what is the per cent of advance?

7. Six boards, each $\frac{7}{8}$ of an inch in thickness, are piled upon one another. How high is the pile?

8. Find the interest on a note for $250 at 4 %, for 2 years 6 months.

9. My grocery order one day was 2 dozen eggs at 42 cents per dozen, 2 loaves of bread at 10 cents each, 1 pound butter at 55 cents. What was the amount of my bill?

10. A lot was bought for $750 and sold for $900. What was the per cent of gain?

11. At 50¢ a yard, what will $\frac{7}{8}$ of a yard of cambric cost?

12. If a strip of carpet is $\frac{3}{4}$ of a yard wide, how many will be needed for a room 8 yards wide?

13. Pure gold is said to be 24 carats fine. What is the per cent of gold in a ring that is 16 carats fine?

21. *Standard Time.*

SCENE I. *Time.* Afternoon of April 2, 1917 — the date on which President Wilson called Congress in special session in regard to the war situation.

Place. Office of the Associated Press in the San Francisco *Daily Star.* Mr. Edson, operator for the Associated Press, is seated before a telegraph instrument writing vigorously. Mr. Johnson, city editor, rushes in, watch in hand.

Mr. Johnson: It is 5:40. Have you no word yet from Washington concerning President Wilson's speech? We should sell thousands of "Extras" tonight.

The American people are roused as they have not been since the Civil War. Have you seen the blockade in front of our bulletin boards?

Mr. Edson: Don't get excited. It surely will be here within five minutes. I never cease to wonder at the telegraph. The operators in Washington will start transmitting the President's speech the moment he begins to deliver it and at no time shall we ever be more than 15 minutes behind him. It is almost as satisfactory as being there in person. Electricity has practically annihilated distance.

Mr. Johnson (laughing): Yes, and in a sense we are making time, for we shall have our "Extras" out three hours earlier in the day than will the Washington papers. Ours will be out by 7 o'clock while theirs cannot possibly get out before 10 o'clock. Consequently our people will read the news before dinner. However, this delay is maddening.

(The telegraph instrument begins to click.)

Mr. Edson: Here it is! The President began speaking exactly at 8:30 in Washington. The message will probably be off the wires in an hour's time.

Mr. Johnson (telephoning to the press room): The President's message is arriving. Rush boy for copy.

SCENE II. One hour later a half dozen newsboys run from the building of the San Francisco *Daily Star,* yelling:

Newsboys: Extra! Extra! President's message to Congress!

22. *Standard Time — continued.*

See previous lesson, pp. 76, 77.

STANDARD TIME BELTS

1. The United States lies between what meridians?

2. Denver and Cheyenne are both located on the 105th meridian. Philadelphia is located on the 75th meridian. When it is 6 A.M. in Philadelphia, what time is it in Denver? In Cheyenne?

3. If the earth revolves eastward 15 degrees in one hour, it revolves one degree in how many minutes?

The railroads of the United States and Canada agreed, in 1883, upon a system of *standard time* with five time belts, each approximately 15° wide. The time belts are called *Atlantic*, with the time of the meridian of 60° W.; *Eastern*, with the time of the meridian of 75° W.; *Central*, with the time of the meridian of 90° W.; *Mountain*, with the time of the meridian of 105° W.; and *Pacific*, with the time of the meridian of 120° W. Practically all time in the civilized governments of the world is now *Standard Time*. Correct time is telegraphed each day to all parts of the United States from the Naval Observatory at Washington.

23. *Find the missing term:*

1. Base $840	Rate 5 %	Percentage?
2. Gain $375	Cost $1500	Rate?
3. Rate $12\frac{1}{2}$ %	Percentage $250	Base?
4. Amt. of sales $47.25	Rate 5 %	Commission?
5. Cost $36.80	Loss $5.52	Rate of loss?
6. Rate of gain $37\frac{1}{2}$ %	Cost $64.80	Gain?
7. Commission $924.70	Amt. of sales $8420	Rate?
8. Rate of loss 28 %	Loss $90.93	Cost?

24. *Before solving write I (integer) or F (fraction) to show whether each of the quotients in the following will be an integer or a fraction:*

1. $18 \div 6 = ?$	**5.** $18 \div \frac{1}{3} = ?$	**9.** $\frac{1}{6} \div \frac{1}{18} = ?$
2. $6 \div 18 = ?$	**6.** $6 \div \frac{1}{3} = ?$	**10.** $\frac{1}{18} \div \frac{1}{6} = ?$
3. $18 \div \frac{1}{6} = ?$	**7.** $\frac{1}{3} \div \frac{1}{18} = ?$	**11.** $\frac{1}{3} \div 18 = ?$
4. $6 \div \frac{1}{18} = ?$	**8.** $\frac{1}{18} \div \frac{1}{3} = ?$	**12.** $\frac{1}{6} \div \frac{1}{3} = ?$

25. *Find the quotient:*

1. $572.323 \div .28$	**6.** $858.861 \div 2.6$
2. $30507.4 \div .37$	**7.** $66189 \div 37$
3. $674.93 \div 1.7$	**8.** $881.683 \div 2.9$
4. $818.72 \div 49.7$	**9.** $680.7 \div 39.6$
5. $684.462 \div .18$	**10.** $334.946 \div 36.7$

26. *At sight:*

1. 20 % of 45 is what per cent of 72?
2. $33\frac{1}{3}$ % of 45 is what per cent of 75?
3. $16\frac{2}{3}$ % of 48 is what per cent of 80?
4. $12\frac{1}{2}$ % of 96 is what per cent of 36?
5. $37\frac{1}{2}$ % of 40 is what per cent of 90?

27*. *Finding the Difference between Dates.*

1. *For study.* Thomas A. Edison visited the office of the *Scientific American* on November 24, 1877. He carried with him a small box. After he had turned a crank, to the astonishment of everyone present, the machine said: "Good morning. How do you do? How do you like the talking box?" On June 16, 1888, Edison perfected his first commercial phonograph after having worked continuously on it for 5 days and nights. How long was it between the completion of his talking box and his commercial phonograph?

yr.	mo.	da.	
1888	6	16	In making calculations count 30 days to the
1877	11	24	month.
10	6	22	

Ten years, six months, twenty-two days elapsed between the completion of Edison's talking box and his commercial phonograph.

2. On August 3, 1492, Columbus and his fleet set sail from Palos, Spain. After his discoveries in the new world he returned to Palos, March 15, 1493. How long was he gone? His death occurred May 20, 1506, after he had made three other voyages. How long was it from the time when he started on his first voyage until he died?

3. Thomas Jefferson became president of the United States on March 4, 1801. On April 30, 1803, the United States purchased the Louisiana Territory. How long had Jefferson been president when this purchase was made?

4. Abraham Lincoln was born February 12, 1809. He was first inaugurated as president of the United States on March 4, 1861. On January 1, 1863 he made the Emancipation Proclamation. How old was he at that time? How long had he been president?

28. *Written Problems.*

1. Packages of tea containing ¾ of a pound are selling for 45¢. At this rate, how much should be paid for a package weighing 1½ lb.?

2. Which is better: to deposit $4500 in a loan association which pays 6% annually or to invest it in a house from which is received $450 rent and upon which is spent $98 taxes, $100 repairs and $15 insurance, annually?

3. In order to pay a note of $450, I drew from bank 37½% of my deposit. How much had I in the bank at first?

4. A man sold two farms for $6000 each. On the one he gained 25%, and on the other he lost 25%. How much did he lose or gain by the transaction?

5. Make and receipt a bill for the following: Rice and Brown bought of J. Hold & Company, August 3, 1917, 160 pounds Java coffee at 35 cents; 140 pounds Mocha coffee at 38 cents; 36 gallons of syrup at 35 cents; 70 lb. black tea at 45 cents, and 40 pounds green tea at 60 cents.

6. Mr. McDonald sold a horse for $280, thereby gaining 25%. Find gain.

7. A house is assessed at $8400 in a town where the rate of taxation is $16.50 on a thousand dollars. How much taxes must the owner pay on the house?

8. If 50 pounds of corn contain 35 pounds of starch, how many pounds of starch do 10 pounds of corn contain?

9. Mother paid $60 one fall for a tailor-made winter suit. The next fall she paid $12.50 to have it cleaned and altered and wore it another season. Then she made a house dress of it which she valued at $7.50. Considering the service she had from the suit, was it more or less economical than to buy a new $40 suit each of the two seasons, then sell each suit to a second-hand clothier for 10% of the cost.

10. A woman owns 6 renting houses from which she averages $32 a month each. Her yearly loss from vacant houses is $300. Her annual income from rents is what per cent of the $20,000 capital invested?

11. A farmer can have his land poorly plowed for $7.20 an acre. It will cost him $12\frac{1}{2}\%$ more to have a good job done. How much would it cost to have 50 acres well plowed?

12. I received $6080 from my agent, who had deducted his commission of 5 %. For how much did he sell the goods?

13. When the train arrived at the railroad station in Buffalo, New York, Mr. Barnard found that his watch (which kept correct time) was 1 hour late. How do you account for this? From what direction had he come?

14. A man bought a farm, agreeing to pay for it in three payments. The first payment was $\frac{3}{8}$ of the purchase price; the second, $\frac{1}{3}$; the third payment was $2100. What was the total amount paid for the farm?

15. A newsboy has 125 customers whom he supplies at 10 cents a week (6 days). He pays 1 cent for each paper. How much money does he make on his investment? What per cent?

16. Mr. Lewis borrowed $750 for 3 years, 6 months, 15 days. How much will be due at the expiration of the time at 6 per cent?

17. Find the cost of plastering the walls and ceiling of a room 18 feet by 21 feet and 12 feet high, at 50 cents a square yard, making an allowance of $\frac{1}{3}$ of the area of the walls for openings and wood-covered portions.

18. If a train travels 210 miles in 6 hours, how far will it travel at the same rate in 7 hours?

19. A farmer sold $\frac{3}{8}$ of his wheat at $2.14 a bushel and received for it $866.70. How many bushels had he at first?

20. A grocer bought 80 lb. of soap at $12\frac{1}{2}$¢ a lb. While on hand it dried away $\frac{1}{4}$ in weight. He sold it at 15¢ a lb. What was his gain or loss per cent?

29.* *Railway Passenger Service — Standard Time.*

See previous lessons, pp. 76, 77, 80.

PENNSYLVANIA LINES

THROUGH TRAINS BETWEEN NEW YORK AND
ST. LOUIS

	Westbound — Daily				
Eastern Standard Time East of Newark, Ohio; Central Standard Time West of Newark, Ohio		No. 27 Commercial Express	No. 21 Keystone Express	No. 31 The St. Louisan	No. 7 Mercantile Express
Miles					
0	Lv. New York ...	9:10 A.M.	1:04 P.M.	5:04 P.M.	5:30 P.M.
85.8	N. Philadelphia .	11:20 A.M.	2:58 P.M.	6:50 P.M.	7:38 P.M.
195.2	Harrisburg	2:00 P.M.	5:55 P.M.	9:05 P.M.	10:35 P.M.
	Ar. E.T.	1:00 A.M.	5:03 A.M.	6:53 A.M.	9:07 A.M.
597.6	Newark, O.				
	Lv. C.T.	12:05 A.M.	4:08 A.M.	5:58 A.M.	8:12 A.M.
810.8	Indianapolis	7:10 A.M.	10:25 A.M.	11:12 A.M.	2:10 P.M.
1051.7	Ar. St. Louis.....	2:00 P.M.	5:54 P.M.	4:54 P.M.	8:45 P.M.

1. An extra fare is charged on the fastest train scheduled above.   What is the number of the train?

2. Train No. 27 arrives at Newark at 1:00 A.M. and leaves at 12:05 A.M.   How do you account for this?

3. How long does each of the trains scheduled remain in Newark?

4. What is the distance between Newark and St. Louis?

5. The fare from Indianapolis to St. Louis is $7.98. What is the rate per mile?

6. How many miles per hour does train No. 27 travel between New York and Harrisburg?

7. Mr. Langsdale paid an extra fare of $4, $6 for a berth in the Pullman car, meals $4 and gave 50¢ to the porter. His transportation ticket cost $31.68.   What was the total cost of his trip?

30. *Find quotient:*

1. $3\frac{3}{4} \div 5\frac{2}{3}$	**5.** $8\frac{5}{8} \div 6\frac{1}{2}$	**9.** $6\frac{2}{3} \div 4\frac{1}{3}$
2. $4\frac{2}{7} \div 4\frac{4}{5}$	**6.** $4\frac{3}{7} \div 5\frac{1}{9}$	**10.** $7\frac{1}{2} \div 3\frac{3}{7}$
3. $9\frac{1}{3} \div 6\frac{1}{3}$	**7.** $7\frac{3}{8} \div 6\frac{2}{11}$	**11.** $4\frac{5}{8} \div 6\frac{2}{3}$
4. $8\frac{4}{5} \div 7\frac{2}{3}$	**8.** $4\frac{4}{5} \div 2\frac{3}{7}$	**12.** $8\frac{1}{3} \div 2\frac{1}{4}$

31. *Give results:*

When × and ÷ occur in succession in an expression, the operations are performed in order beginning at the left.

1. $18 \div 6 + 9 - 2 + 5 = ?$	**5.** $9 \times 2 + 6 + 12 - 6 = ?$
2. $7 - 10 \div 2 + 12 \times 3 = ?$	**6.** $17 + 9 \div 3 - 2 \times 7 = ?$
3. $7 \times 2 - 24 \div 3 + 9 = ?$	**7.** $29 - 8 \times 2 + 27 \div 3 = ?$
4. $7 + 8 - 36 \div 9 \times 3 = ?$	**8.** $14 \div 2 + 8 - 16 + 2 = ?$

32. *Write quotient as a decimal (two places). Change to per cent:*

1. $25 \div 50 = ?$	**6.** $10 \div 160 = ?$	**11.** $132 \div 352 = ?$
2. $16 \div 96 = ?$	**7.** $20 \div 240 = ?$	**12.** $135 \div 162 = ?$
3. $32 \div 256 = ?$	**8.** $36 \div 216 = ?$	**13.** $406 \div 464 = ?$
4. $58 \div 174 = ?$	**9.** $168 \div 192 = ?$	**14.** $252 \div 567 = ?$
5. $80 \div 96 = ?$	**10.** $186 \div 279 = ?$	**15.** $87 \div 116 = ?$

33. *At sight:*

1. 72 is $\frac{5}{8}$ of what number?	**5.** 81 is $\frac{9}{8}$ of what number?
2. 96 is $\frac{6}{8}$ of what number?	**6.** 24 is $\frac{3}{7}$ of what number?
3. 54 is $\frac{9}{8}$ of what number?	**7.** 36 is $\frac{9}{7}$ of what number?
4. 42 is $\frac{6}{8}$ of what number?	**8.** 18 is $\frac{3}{2}$ of what number?

34. *What is the cost?*

Selling Price	Gain		Selling Price	Loss
1. $450	$\frac{1}{3}$		**4.** $450	$\frac{1}{3}$
2. $600	$\frac{1}{4}$		**5.** $600	$\frac{1}{4}$
3. $770	$\frac{3}{8}$		**6.** $770	$\frac{3}{8}$

35.* *Simple Interest — Cancellation Method.*

See previous lessons, pp. 20, 21, 22, 28.

1. *For study.* What is the interest on a note for $420 dated April 15, 1917, and paid August 27, 1917, at 5% interest?

1917	8	⁃	27	4 mo. = 120 days
1917	4		15	12 da.= 12 days
	4		12	Total Time = 132 days or $\frac{132}{360}$ yr.

$$\frac{\overset{\overset{11}{\cancel{132}}}{\cancel{360}}}{\underset{\underset{10}{\cancel{30}}}{}} \times \frac{\overset{1}{\cancel{5}}}{\underset{1}{\cancel{100}}} \times \frac{\overset{\overset{7}{\cancel{21}}}{\cancel{\$420}}}{1} = \frac{\$77}{10} = \$7.70$$

The interest on the note was $7.70.

The time and the rate are expressed as common fractions and the process is shortened by cancellation. Test the answer given above by obtaining the interest by the method you already know. Why do they give the same result? This process is advisable only in problems where the time is less than one year.

Find the interest on:

2. $625, at 5%, from January 29, 1919, to March 5, 1919.

3. $600, at 2%, from February 4, 1919, to Sept. 10, 1919.

4. $850, at 3%, from November 5, 1919, to June 20, 1920.

5. $500, at 5%, from October 17, 1919, to August 9, 1920.

6. $1500, at 6%, from March 8, 1918, to June 26, 1918.

7. $540, at 2%, from June 3, 1919, to April 18, 1920.

8. $450, at 6%, from April 9, 1919, to August 24, 1919.

9. $300, at 3%, from June 22, 1919, to April 7, 1920.

10. $375, at 6%, from January 14, 1919, to May 15, 1920.

11. $320, at 7%, from Sept. 28 to December 31 of the same year.

12. $425, at 4%, from April 25, 1919, to Nov. 17, 1919.

13. $1500, at 4%, from June 8, 1919, to December 29, 1919.

14. $240, at 3%, from April 8, 1919, to Feb. 21, 1920.

36. *Oral Problems.*

1. Large grapefruit are sold at 15 cents each: small grapefruit at 3 for a quarter. What is the difference in price per dozen?

2. A woman can buy a silk waist of a certain kind for $4.50. She can make herself a waist from $2\frac{1}{2}$ yards of dollar silk. If she counts her own work and "findings" as worth $1.50, has she gained or lost?

3. A man collected a bill for $760 and received 2% commission. How much was the commission?

4. What is the interest on $500 for 1 yr. 6 mo. at 6%?

5. A coat cost $2\frac{1}{3}$ times as much as a vest. If the vest cost $6, what was the cost of both?

6. Allowing $\frac{1}{5}$ of an hour per pound, when should a 9-pound turkey be put on to roast for a one o'clock dinner?

7. Elmer sold a bicycle for $21. This was $87\frac{1}{2}$% of what it had cost him when new. How much had it cost him?

8. If a man owns 80% of a farm and sells 25% of his share for $2000, what was the whole farm worth?

9. Four children have a garden containing $\frac{1}{4}$ of an acre. If they plant equal portions, what part of an acre does each plant? What per cent?

10. In an orchard are 12 rows of peach trees with 32 trees in a row. How many trees in the orchard?

11. If one peck of apples yields 3 quarts of cider, how many pecks will it take to yield 3 gallons?

12. What is the cost of 8 boys' suits at $12\frac{1}{2}$ each?

13. After selling $16\frac{2}{3}$% of his sheep, a farmer had 75 left. How many had he at first?

14. $\frac{4}{5}$ of 80 = ?

37. *What number increased by:*

1. $16\frac{2}{3}\%$ of itself = 49?
2. $37\frac{1}{2}\%$ of itself = 99?
3. $66\frac{2}{3}\%$ of itself = 60?
4. $87\frac{1}{2}\%$ of itself = 45?
5. $62\frac{1}{2}\%$ of itself = 91?

6. $83\frac{1}{3}\%$ of itself = 110?
7. $12\frac{1}{2}\%$ of itself = 81?
8. 40% of itself = 84?
9. 75% of itself = 91?
10. 25% of itself = 40?

38. *What number decreased by:*

1. $16\frac{2}{3}\%$ of itself = 45?
2. $37\frac{1}{2}\%$ of itself = 25?
3. $66\frac{2}{3}\%$ of itself = 20?
4. $87\frac{1}{2}\%$ of itself = $2\frac{1}{2}$?
5. $62\frac{1}{2}\%$ of itself = 21?

6. $83\frac{1}{3}\%$ of itself = 9?
7. $12\frac{1}{2}\%$ of itself = 84?
8. 40% of itself = 24?
9. 75% of itself = $12\frac{1}{2}$?
10. 25% of itself = 33?

39. *Written Dictation.*

1. $83\frac{1}{3}\%$ of 24 is 80% of what number?

2. $5 \times 1\frac{7}{8} = ?$

3. Find the net price on a bill of goods for $120 discounted at 10%.

4. When berries are 20 cents a pint, how much will I pay for one crate of 24 pints?

5. James sold his bicycle for $40 at a loss of $33\frac{1}{3}\%$. How much did he pay for it?

40. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
679	367	498	694	586	778
678	888	741	678	687	223
978	768	929	761	777	879
697	998	876	876	988	458
986	786	499	765	955	764
989	669	818	789	587	338
879	998	698	767	699	977
698	747	475	901	245	842
798	959	397	843	477	498
799	996	989	874	967	798

41. * *Commission with Other Expenses.*

1. *For study.* An agent sold a car load of sheep for $1500. What were the net proceeds of the sale if he paid $150 freight charges and deducted a commission of 2%?

Solution

$1500
  .02
────────
$30.00 Commission
$150.00 Freight
$180.00 Entire Expense
$1500 − $180 = $1320 Net Proceeds.

Why must the commission be computed upon the entire amount of sales?

2. A real estate agent sold a tract of 340 acres of land at $75 an acre. He charged the owner a commission of 2%. The transfer cost $85 additional. How much should be paid to the owner?

3. An agent sold a consignment of 8 motor-trucks at $1800 each. He charged a commission of 5%, and paid delivery charges amounting to $125. Find the net proceeds.

4. A commission merchant sold 480 dozen eggs at $.42 a dozen. After deducting a commission of 4% and other expenses amounting to $3.75, how much should he remit to his principal?

5. Find the entire cost of 1200 bu. of wheat at $2.11 a bushel, if the purchasing agent charged a commission of 2% and the freight charges amounted to $96.50.

6. A commission merchant sold 450 lb. of dressed turkey at $.38 a pound. He charged a commission of 5%, and his other expenses amounted to $3.50. Find the net proceeds of the sale.

7. How much money should I send my agent to pay for 150 tons of bran at $22 a ton, and pay his commission amounting to $2\frac{1}{2}$%?

8. The cost of a bill of goods, including a commission of 2 % and $75.84 other expenses, was $2500; find the commission charged.

9. A salesman receives a monthly salary of $160 and, in addition, a commission of 5 % on his sales. His sales must amount to what sum annually to give him an income of $3600?

10. Mr. Lewis sold 500 barrels of flour at $12.50 a barrel and sent me a check for $6125. What rate of commission did he charge?

11. What is the yearly income of a salesman who sells $80,000 worth of goods at 5 % commission? If his expenses are $120 per month, what is his net income?

12. Mr. Henry employed a lawyer to collect a debt of $240. He succeeded in getting 75 % of it, on which he charged a commission of 5 %. How much did Mr. Henry receive?

13. My agent bought a car load (720 bu.) of potatoes for me at $1.80 a bushel, commission 3 %. What was his commission? How much per bushel did it add to the cost? If freight, drayage, and other expenses are 15¢ a bushel, for how much a bushel must I sell them to make 25 %?

14. A commission agent sells for a fruit grower 250 boxes of oranges at $4.75 and 400 boxes of grapefruit at $6.25, charging as his commission 5 %. What were the net proceeds received by the fruit grower?

In the following problems supply the missing terms:

	Amount of Purchase	Rate of Commission	Commission	Other Expenses	Entire Cost
15.	$200	12½ %	?	$10	?
16.	?	5 %	$40	$20	?
17.	$100	?	?	$5	$113
18.	?	4 %	?	$60	$1100

42.* *Relation between the Cost and Selling Price.*

See previous lesson, p. 78.

Preliminary Exercise.

1. *a.* $12 \times \frac{4}{3} = 16$
  b. $16 \div \frac{4}{3} = ?$

2. *a.* $18 \div ? = 15$
  b. $15 \div \frac{5}{6} = ?$

3. *a.* $24 \times \frac{7}{6} = ?$
  b. $28 \div ? = 24$

4. *a.* $15 \times \frac{2}{3} = ?$
  b. $10 \div ? = 15$

5. *a.* $21 \times \frac{5}{7} = ?$
  b. $? \div \frac{7}{5} = 21$

6. *a.* $9 \times ? = 15$
  b. $15 \div ? = 9$

1. *For study.* *a.* A city lot which cost $800 was sold at a gain of 20 %. What was the selling price?

b. A city lot was sold for $960. This was a gain of 20 %. What was the cost price?

Solution (Short method)

I. $\frac{6}{5} \times \$800$ (or c.) = $960 (or s. p.)
II. $1.20 \times \$800$ (or c.) = $960 (or s. p.)

  The selling price was $960.

Solution (Short method)

I. $960 (or s. p.) $\frac{6}{5} \div = \$800$ (or c.)
II. $960 (or s. p.) $\div 1.20 = \$800$ (or c.)

  The cost was $800.

2. A piano was sold for $450, which was a loss of 10 %. What was the cost?

3. A farm was sold for $2200, which was a gain of 10 %. What was the cost?

4. *a.* $160 c. $\times 1.12\frac{1}{2} = \$?$ s. p.   *b.* $180 s. p. $\div ? = \$160$ c.

5. *a.* $360 c. $\times 1.16\frac{2}{3} = \$?$ s. p.   *b.* $420 s. p. $\div ? = \$360$ c.

6. A city lot was sold for $3300. This was an advance of 10 %. What was the cost?

7. An automobile was sold for $1400. This was $87\frac{1}{2}\%$ of the cost. What was the cost?

43. *Find the gain or gain per cent:*

	Cost	Marked Price	Discount	Gain
1.	$1.50	$1.75	10 %	$?
2.	$2.10	$2.95	20 %	$?
3.	$3.60	$4.80	20 %	% ?
4.	$6.00	$8.00	15 %	% ?

44.* *Grouping Numbers: The Parenthesis.*

Whatever is inclosed in a parenthesis is to be considered as one quantity. For that reason, the operation within the parenthesis should be performed before the parenthesis is removed.

1. *For study.*

a. $7 \times 2 - 6 + 3 = 11$ b. $7 \times 2 - (6 + 3) = 5$

2. $7 \times 3 + 8 \div 2 = ?$ **6.** $9\frac{3}{4} - (4\frac{1}{2} + 2\frac{1}{4}) + \frac{1}{6} = ?$

3. $(6 - 4) \times 3 + 6 = ?$ **7.** $7 \div \frac{1}{2} - (1\frac{1}{2} \div \frac{1}{6}) = ?$

4. $4 \div (8 - 6) + 8 = ?$ **8.** $\frac{5}{6} \times (4\frac{2}{3} \div 7) + 9 = ?$

5. $16 \div \frac{1}{2} + (\frac{1}{2} \times 2) = ?$ **9.** $(6\frac{2}{3} \times \frac{1}{2}) + 6\frac{1}{2} - 2\frac{5}{6} = ?$

45. *Find the commission and the net proceeds:*

Article	Selling Price	% Commission	Freight
1. 180 boxes lemons	$ 4.20	4 %	$12.50
2. 240 geographies	$ 1.12	25 %	$ 8.75
3. 2500 bu. corn	$ 1.95	2 %	$48.32
4. 300 bbl. flour	$12.00	3 %	$18.00
5. 850 lb. sugar	$ .12	5 %	$ 5.23
6. 160 watermelons	$ .45	3 %	$ 6.25
7. 20 crates black raspberries	$ 4.75	5 %	$ 2.25

46. *Reduce to % and memorize:*

$$\tfrac{1}{16}; \ \tfrac{1}{12}; \ \tfrac{1}{7}; \ \tfrac{1}{9}; \ \tfrac{1}{24}.$$

47. *Find the difference in time between:*

1. June 26, 1919, and May 15, 1920.

2. May 7, 1915, and June 22, 1916.

3. Aug. 5, 1916, and Oct. 17, 1919.

4. April 9, 1914, and Aug. 24, 1918.

5. Jan. 29, 1919, and March 5, 1920.

6. July 19, 1919, and Aug. 12, 1920.

7. March 3, 1915, and April 18, 1917.

8. Sept. 20, 1916, and Aug. 8, 1919.

9. March 8, 1913, and June 26, 1917.

10. Jan. 4, 1919, and May 19, 1920.

48. *Written Problems.*

1. A man who has been paying $22.50 a month rent borrowed money at 6% and purchased a cottage at $2250. The taxes on the place were $43, the cost of repairs was $32, and the insurance $3.50. How much did he save a year by owning his own house?

2. A newsboy supplies papers to eighty customers at 20 cents per week. He is allowed a commission of 40% and is responsible to the dealer for all collections. If on the average two customers fail to pay, what are his annual earnings?

3. The battle of Concord was fought April 19, 1775. Cornwallis surrendered to Washington at Yorktown October 19, 1781. How long was the war in progress?

4. An agent receives $120 commission at 2% on a purchase of flour at $12 per barrel. How many barrels does he buy?

5. Find the amount due June 10, 1920, on a note for $450 dated January 1, 1920, with interest from date at 6%.

6. Gloves that were bought for $1.20 per pair were retailed at a gain of 33⅓%. What was the selling price of 10 dozen?

7. An agent sold a farm for $6750, receiving $270 commission. What was the rate of commission?

8. What will be the interest on $87.60 from April 3, 1916, till January 2, 1922, at 4%?

9. A fast train between New York and St. Louis arrives in Pittsburgh at 3:52 A.M. eastern time and arrives in St. Louis on the same day at 5:52 P.M. central time. How long is it in making the distance between Pittsburgh and St. Louis?

10. A man borrowed $4200 which he put into his business. He paid 6% interest on the money, but his business yielded him a profit of 8%. What was his yearly profit upon the borrowed money?

11. A note whose principal is $800, dated June 1, 1917, and bearing interest at 6% was paid November 19, 1920. Give the amount paid.

12. Mr. Burton purchased farming implements, paying cash $215. This left him in debt $37\frac{1}{2}$% of the purchase price. What was the price of his implements?

13. If 12 quarts of milk yield 3 pints of cream, what per cent of the milk is cream?

14. What will be the gain per week in baking bread for a family which uses on an average 3 ten-cent loaves a day, if to bake an equal quantity it takes 9 lb. of 7¢ flour; yeast 2¢; potatoes, sugar and salt 3¢; gas for 1 hr. 10¢; labor 25¢?

15. A dealer buys 1000 dozen eggs at 55¢ and sells them through a commission merchant at 62¢. What was his profit if the rate of commission was 2%?

16. Find the interest on $238.40 for 1 yr. 5 mo. 12 da. at 6%.

17. A real estate dealer sold 57 acres of land at $105 per acre. He received 5% commission on the first and second thousand and 2% on the remainder. What was the amount of his commission?

18. A man sold his house for $3600, thereby losing 10% of the cost. Later he found he might have sold it for $800 more than he did. Would he have gained or lost, and how much?

19. If I sell goods at a commission of $8\frac{1}{3}$%, what must be the amount of my sales in order that I may receive a salary of $2000?

20. A house was bought for $1800. The buyer paid 20% in cash, 25% of the remainder was paid a month later, and at another time $33\frac{1}{3}$% of what still remained was paid. How much did he still owe?

21. Mr. Jones and Mr. Laymon engaged in partnership. Mr. Jones invested $2000 and Mr. Laymon $3000. What per cent of the capital of the firm did each invest?

49.* *The Area of a Right Triangle.*

1. To construct a blotter pad. Take a stiff piece of cardboard 11″ × 18″. From heavy art paper cut two rectangles 6″ square. Cut along the diagonal of each square as indicated, making four right triangles. One inch from the edge of each triangle draw two lines parallel respectively to the *base* and the *altitude* (bottom and height). Cut out the square inch found in the corner; fold along the pencil lines. Slip over the corners of the blotter pad and paste. On the reverse side of the pad paste a neat lining paper, leaving a margin ¼ of an inch around the edge.

a. A rectangle 6 inches square contains 36 square inches. A right triangle whose base and altitude are each 6 inches will contain what part of 36 square inches?

b. Construct rectangles of several dimensions and divide each of these into two right triangles. How does the area of each of these triangles compare with the area of the rectangle whose base and altitude are the same?

2. Michigan Street runs east and west and Fort Wayne Avenue directly northeast. How many square feet in a lot at the intersection of these two streets which faces 80 feet on Michigan Street and 60 feet on the alley extending north from Michigan Street to Fort Wayne Avenue?

3. Charles made a sail for his toy boat in the shape of a right triangle. The altitude was 24 inches and the base 18 inches. How many square inches did it contain?

50.* *Wasson's Retail Hardware Store — Continued Discount.*

Mr. Sayles (agent for the Computing Scale Company): Good morning, Mr. Wasson. May I have a few moments of your time this morning?

Mr. Wasson: Yes, indeed. I was about to wire for new quotations on your scales.

Mr. Sayles: I have advice this morning from the company allowing a further discount of 10 % on last year's discount of 25 %. For example, our style No. 146 Electric last year was priced to you at $80 with a discount of 25 %, which made it cost you $60. This year with a further allowance of 10 % you get the same machine for only $54.

Mr. Wasson: I am very glad of that. Your machines are popular and with this further reduction I shall hope to sell a number of them to the butchers in our new city market. You may place my order for six of them to be delivered at once.

Mr. Sayles: They are selling so fast that we can scarcely keep up with the manufacture. My company is therefore allowing 5 % discount for payment within 30 days. We need ready money to turn over into the business.

Mr. Wasson: I will send a check for the goods on receipt of the bill. As I understand it, each machine will cost me $———.

Mr. Sayles: Thank you very much for the order. You may expect the shipment early next week. We are having fine weather. Good morning.

Problems in Continued Discount.

1. Find the net cost of my automobile which was listed at $720 with discounts of $16\frac{2}{3}$ % and 5 %.

2. How much difference is there between a direct discount of 30 % on a bill of goods for $870 and successive discounts of 15 %, 10 % and 5 %? Which one is better for the buyer?

3. A merchant bought hardware the list price of which was $367.98. The discounts were $16\frac{2}{3}$ % and 5 %. How much did he pay?

4. Make out a bill for the following: Mr. R. M. McNabb, Dayton, Ohio, bought of Lamb and Son, Importers of China, Glass and Queensware, on terms, cash: 6 doz. #6482 plates @ $2.60; ½ doz. #6482 coffee cups @ $2.40; 3 #6482 covered dishes @ $1.65; 8 doz. #6482 fruit plates @ $2.25; 5 doz. #6482 tea cups @ $2.50; 2 doz. #6482 casseroles @ $1.50. Less discounts of 10% and 5%.

5. A bill for lumber amounted to $500. Discounts of 20% and 10% were allowed. How much was paid?

6. Bought $624.60 worth of books, the seller making a discount of 33⅓% and 5%. What was the amount to be paid?

7. A merchant buys a bill of goods amounting to $850, with discounts of 20% and 5%. Find the net amount of his bill.

8. The catalogue price of a rug is $120. The discounts allowed are 16⅔%, 12½% and 5% for cash. What is the cash price?

9. The list price of hand saws is $38 per dozen. A Chicago wholesale house bought six dozen at 25% and 10% off. What was the net cost?

10. Find the net cost of a lot of books and stationery listed at $675, on which discounts of 20% and 10% are allowed.

11. The hardware for my house was $119, list price. I was allowed 9% and 12% discounts. How much did I pay?

51. *Find the value of:*

1. $48 - (16\frac{3}{4} + 15\frac{1}{2}) = ?$ **4.** $235 \div (18\frac{3}{4} - 6\frac{1}{4}) = ?$

2. $(24\frac{1}{3} + 18\frac{1}{2}) \times 192 = ?$ **5.** $(9 \times 32\frac{1}{3}) - (6 \times 12\frac{2}{3}) = ?$

3. $(394 + 21) \div 12\frac{1}{2} = ?$ **6.** $271 - (94\frac{1}{3} + 12\frac{1}{9}) = ?$

Complete and learn:

The area of a right triangle is equal to one half the area of a _____ having the same base and altitude.

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52. *Review Questions.*

   1. What is the meaning of *"per cent"?*

   2. Define *base, rate, percentage.*

   3. To what is the product of the *base* and *rate* equal?

   4. How do you find the *base* when the *percentage* and the *rate* are given?

   5. How do you find the *rate* when the *base* and *percentage* are given?

   6. Can a man gain 150 %? Can he lose 150 %?

   7. What is the gain per cent if I buy at 60¢ and sell at 80¢?

   8. What is the loss per cent if I buy at 80¢ and sell at 60¢?

   9. If I lose a new 10¢ notebook, what is my loss per cent? One that cost 20¢?

   10. If I find a dime, can I tell the gain per cent?

   11. If the selling price is $\frac{8}{5}$ of the cost, what is the gain per cent?

   12. If the cost is double the selling price, what is the loss per cent?

   13. A farmer planted a peck of corn and raised 200 bushels. How would you find the gain per cent?

   14. Define *discount; marked price.*

   15. What is *commission? Net proceeds?*

   16. Who is the *maker* of a note? The *payee?*

   17. How is the amount of a note found when the *face*, the *time* and the *rate* are given?

   18. What is meant by the *assessed value* of a piece of property?

   19. Which of the arithmetical signs take precedence over the others?

   20. What do you do with numbers grouped within a parenthesis?

   21. The interest for 2 years is double the interest for one year. Is this true of the amount? Why?

   22. Would you advise buying upon the installment plan if you could possibly pay cash? Why?

53. *On the New York Dock.   United States Customs.*

First Customs Officer (*touching his cap*): May I inspect your trunks, madam?

Madame Trimble (*modiste*): Certainly.   These three are mine.

First Customs Officer: Please give me your declaration. Have you filled out everything carefully?

Madame Trimble (*handing him the government's printed list of dutiable articles which she has checked*): I have imported goods for my business for ten years.   I have never failed to declare everything.   Here, also, are all of my Paris receipts showing the amounts of my purchases.

First Customs Officer (*after examining her trunks*): You are ready to take oath that this declaration is a complete list of all merchandise you are importing?

Madame Trimble: I am.   (*Holds up her right hand and takes the oath.*)

The customs officer stamps and returns to Madame Trimble her declaration.   She then takes it to the customs office.

Second Customs Officer: I see your declaration, madam, is for 7500 francs.   The *ad valorem* duty of 25 % will be $——.

Madame Trimble pays her duty to the second officer, who pastes on each piece of her baggage a white tag "Customs passed, August 20, 1919."

The United States government derives part of its income from a tax or tariff levied by an act of Congress on goods imported from other countries. This tax is called an *import* or *custom duty*. When duties are collected according to a per cent of the value we have *ad valorem duty;* when at a fixed rate per pound, gallon, etc., we have *specific duty*. When the importer himself brings the goods into the country, the goods are inspected and duties paid at the seaport of entry. When goods are imported by mail order, the goods are examined and customs paid at the final destination.

Problems.

1. Find the duty:

Imports	Value or Quantity	Tariff
1. Silk................$6250		50 %
2. Blankets.........$3480		35 %
3. Cheese..........$320		20 %
4. Toys.............$1275		35 %
5. Olive Oil.........450 gallons		30¢ a gallon
6. Decorated China..$1890		55 %
7. Fireworks........500 lb.		10¢ a pound
8. Pineapples.......7500		$5 per M
9. Gloves...........250 dozen		$1 per dozen

2. A San Francisco firm imported 250 square yards of Japanese matting. How much duty was paid on them at 2½¢ per square yard?

3. What is the import duty on 1400 pounds of Edam cheese at 60¢ a pound, if the tariff rate is 20 % *ad valorem?*

4. What is the duty on 300 boxes of Messina raisins, each box containing 24 pounds at 18¢ a pound, if the tariff rate is 10 % *ad valorem?*

5. What is the duty on 250 yards of English wool suiting worth $4.50 per yard at 35 % *ad valorem?*

6. Make an original problem on Customs and Duties.

7. A church corporation imported stained glass worth $11,500. If the tariff rate was 45% *ad valorem*, what was the amount of the import duty?

8. What is the duty on 200 yards of Brussels lace worth $3.25 per yard at 60% *ad valorem?*

9. What is the duty on 500 yards of table linen worth 80¢ a yard at 60% *ad valorem?*

10. How much duty would a New York silk merchant pay on a shipment of skein silk costing 1500 francs in Lyons that was taxed 35% *ad valorem?*

11. A hardware dealer imported from Sheffield, England, 40 dozen razors valued at $8 a dozen. Transportation cost $7.50. If the tariff rate was 55% *ad valorem*, how much to the nearest cent did each razor cost?

12. The Frank Gall Carpet Company imported rugs from Persia to the amount of $15,000. What must they receive for the rugs if in addition to the import duty of 35% they must realize 25% on the total cost?

13. One year importers of sugar paid in duties $61,480,000 at the rate of 58% *ad valorem* duty. What was the total value of the sugar imported that year?

14. A grocery firm imported 800 gallons of olive oil at $1.25 a quart. What must they charge per quart to clear a profit of 30% and pay a duty of 30¢ a gallon?

15. The candy importers of New York find it necessary to purchase candy from the most remote regions of the world in order to satisfy the demands of emigrants who come from those regions. What is the duty paid by an importer on 1275 pounds of cheap candy at 2¢ a pound and $3460 worth of expensive candy at 25% *ad valorem?*

16. Paintings valued at 25,400 francs were imported from Paris. Freight and insurance charges were $16.25. If the tariff rate was 15% *ad valorem*, what was the total cost?

54. *Oral Problems.*

1. If 75 % of a ship is worth $600,000, what is $37\frac{1}{2}$ % of it worth? Ratio.

2. How much is gained on a sale of 6 grapefruit sold at the rate of 3 for 50¢ if they were bought at 2 for 25¢?

3. Find the cost of $4\frac{1}{2}$ tons of hay when 9 tons cost $324. Ratio.

4. Lucy is 50 miles from home and travels $\frac{3}{4}$ of the distance in one day. How far does she travel?

5. What is the import duty on $800 worth of English books at 25 %?

6. Eighty acres of land at $60 an acre will cost the same as 40 acres at $—— an acre? Ratio.

7. A boat went 16 miles in $3\frac{1}{5}$ hours. How long did it take it to travel one mile?

8. What is a man's tax at $2 on the $100 for property assessed at $5000?

9. Find the cost of a barrel of flour when 75 % of a barrel cost $9.

10. A woman spent $4 for linen at $$\frac{4}{5}$ a yard. How many yards did she buy?

11. How many quart boxes can be filled from $1\frac{1}{4}$ bushels of berries?

12. At $37\frac{1}{2}$¢ a yard, how many yards of dress goods can be bought for $3?

13. At the rate of 3 lemons for 10 cents, how many dozen can be bought for 60 cents? Ratio.

14. One pound, one shilling, one pence in English money is equivalent, respectively, to what amount of our money?

15. How many pounds of tea in twenty 4-ounce packages? Two ways.

16. Ralph had half a dollar. He spent 40 % of it for a ball, 20 % of it for a box of paints, and the rest for paper and pens. How much did he spend for paper and pens?

55. *Child Welfare — Discussion.*

1. The Children's Bureau of the Department of Labor is endeavoring to save the lives of 100,000 babies which is $33\frac{1}{3}\%$ of the total number who die annually from preventable diseases. How many more babies needed attention?

2. One child in four dies in Russia before completing its first year; in the United States, one child in ten; and in New Zealand, one child in twenty. Make a graph to show these ratios. Why is this a national problem?

3. In a tenement house district in New York City, where there were 7972 children in 2200 families, 4797 quarts of milk daily were used during October 1916 (the normal quantity would have been 8194 quarts daily). On account of the advance in the cost of milk, these people one year later were using only 3193 quarts. Give two conclusions that can be drawn from this data. Use round numbers.

4. In September 1917 five states had no compulsory education law and nine states allowed children under 16 years of age to work at night. Restate these facts, using per cents obtained from round numbers.

5. In a certain state an effort was made to find the relation between the rate of promotion of 5656 pupils from grade to grade and their absence record, with the cause of absence. State two mathematical facts that you learn from these figures:

Absence because of:	Per cent of Promotion
Migration 847	56.6
Farm work 2218	63.5
Housework 771	71.5
Other causes 1649	79.7
No absence 171	95.9

56. * *Finding Fractional Per Cents.*

1. Draw a square $2\frac{1}{2}$ inches on each side. Divide this square into 100 smaller squares.

a. Show $\frac{1}{2}$ of the large square. What per cent is it?

b. Show 1 % of the large square. $1\% = \frac{1}{100}$ of the square.

c. Show $\frac{1}{2}$ % of the large square. $\frac{1}{2}\% = \frac{1}{?}$ of the square.

d. Write as decimals: 50 %; 5 %; 1 %; $\frac{1}{2}$ %.

2. What is meant by $\frac{1}{4}$ of anything? By $\frac{1}{4}$ % of anything?

3. Write as common fractions and as decimals:

a. For study. $\frac{3}{4}\% = ?$

(1) $1\% = \frac{1}{100}$
$\frac{1}{4}\% = \frac{1}{4}$ of $\frac{1}{100}$ or $\frac{1}{400}$
$\frac{3}{4}\% = \frac{3}{400}$

(2) $1\% = .01$
$\frac{1}{4}\% = .01 \div 4 = .0025$ or $.00\frac{1}{4}$
$\frac{3}{4}\% = .0075$ or $.00\frac{3}{4}$

b. $\frac{1}{2}\%$ *c.* $\frac{1}{8}\%$ *d.* $\frac{3}{8}\%$ *e.* $\frac{1}{6}\%$ *f.* $\frac{5}{8}\%$

4. How many times will $\frac{1}{8}$ % be contained in $\frac{1}{8}$ of anything?
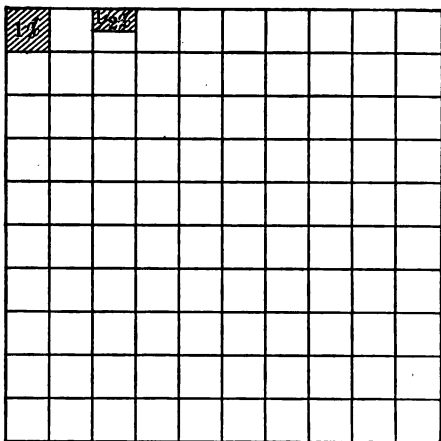
57. *Written Dictation.*

1. $.075 \div 5 = ?$

2. 12 is what per cent of 144?

3. If tea is worth $\$\frac{3}{4}$ a pound, what must I pay for $\frac{1}{3}$ of a pound?

4. If the percentage is \$75 and the rate is 3 %, what is the base?

5. Mr. Adams sold a table for \$60, which was a gain of 20 %. What was the cost?

58. *Written Problems.*

1. A dry goods dealer imported 500 dozen linen hand-kerchiefs costing 8 shillings per dozen in Dublin. After paying 45 % *ad valorem*, what must he charge per dozen to realize 20 % profit? Allow $50 for transportation.

2. A clerk receives $10 a week and $1\frac{1}{2}$ % on all goods sold. If he sells $492 worth of goods, what is his income for that week?

3. My agent sells 700 barrels of flour at $12 a barrel and sends me a check for $8232. What rate of commission does he charge?

4. In buying property, Mr. Zemer gives his check for $2466, which is 60 % of all the money he has in the bank. How much money has he in the bank?

5. A sales clerk bought the following at the store in which she worked, thereby getting a 10 % discount:

$4\frac{1}{2}$ yards net at $1.75
$\frac{5}{8}$ of a yard of lace at $1.50
$6\frac{1}{4}$ yards of silk at 85¢

What was the amount of her bill?

6. George Adams purchased a corner lot for $1200. He was assessed $360 for street and sidewalk improvements by the city and had to pay $20 yearly for taxes. Two years after buying the lot he sold it for $2000. What was his gain per cent on the total amount of money expended?

7. This pennant is made of a strip of white and a strip of red felt. How many square inches of each color does it take? How many square yards of each kind of felt would it take to make 5 dozen pennants of this kind?

8. Find the interest on $2350 for 3 months, 16 days at 4%. Cancellation method.

9. On March 31 the gas meter read 28,600 cu. ft. and on April 30 it read 31,200 cu. ft. What should be the bill for April, at 60¢ per 1000 cu. ft.?

10. A merchant bought hats at $18 per dozen and sold them at $2.50 each. What was his per cent of gain?

11. How much tax would a man pay on $10,000 worth of property assessed at $\frac{3}{4}$ of its value if the tax rate is $2.15 on $100?

12. Mr. Alling who left San Francisco at noon Monday, Pacific time, arrived in New York at noon Saturday, eastern time. How long was he in making the journey?

13. Cyrus W. Field laid the first submarine cable between July 7 and August 4, 1866. Give exact number of days including both dates.

14. A woman pays monthly the following expenses: groceries $82, help $9, laundry $6, sundry supplies $8. If the yearly total of these monthly expenses equals $62\frac{1}{2}$% of her annual income, what is her income?

15. Frank and Russell Gray each received $5000 from their father's estate. Frank lent his money to his uncle and received 6% interest on it. Russell invested his in a double house for which he received $22.50 a month from each tenant. One side of the house was vacant 3 months during the year, and the taxes and insurance amounted to $56.80 and repairs amounted to $35. Allow 1% of cost for depreciation. Which brother received the greater per cent of profit on his share of the estate? How much greater?

16. Make out and receipt a bill with the following items: December 20, 1918, J. J. Cleland bought of Charles May & Son one dozen Limoges plates @ $17.50; three candle-sticks @ $1\frac{7}{8}$; one-half dozen teaspoons @ $12\frac{3}{5}$.

17. Find interest on $5600 for 3 mos. at 8%.

59.* *Equivalent Food Values.* — For class discussion.

1pt. or 1lb. of Milk.   Bread,   Apples,
5 oz. of Protein.   6.4oz.   12 lbs. 4oz.
Beef: 3oz.

Eggs,   Potatoes,   Cheese,   Beans,
4.9oz.   2 lbs.   2.2oz.   2.6oz.
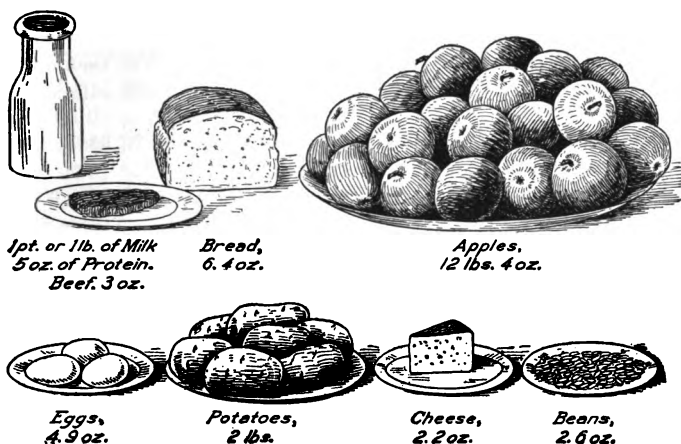
Every intelligent person is careful to eat food that is nourishing in itself and also has a proper balance of food qualities in relation to the rest of his diet. For example, beef is a nourishing food, but a heavy meat diet would fail to give us some of the most important food elements which are necessary to the body. These food elements are:

1. *Protein,* the body-building food. Foods high in protein are lean meat, fish, poultry, eggs and cheese.

2. *Carbohydrates,* fuel foods giving the body heat and energy. Foods high in carbohydrates are sugar, bananas, rice, wheat flour.

3. *Fats and Oils,* also fuel foods. Foods high in fats are butter, cream, olive oil, bacon, lard, etc.

4. *Mineral Salts* build bone and other tissue and aid digestion. Foods high in mineral salts are milk, egg yolk, cereals, fruits and green vegetables.

5. *Water.* Water forms a part of all body tissue, making up about $\frac{3}{4}$ of the body weight.

The calorie is the measure of the fuel value of food. It is the amount of heat which will raise 1 pint (or pound) of water four degrees Fahrenheit.

The following is a fair estimate of the total energy required for one day:

    Man at moderate muscular work.............3400 calories
    Woman at moderate muscular work...........2720 calories
    Child 10 to 13 years of age...................2200 calories

It has been found that if the food contains the right amount of calories and 10% of these are supplied by the protein in the diet, the average individual is properly nourished.

1. Select from the table the ten foods that have the highest per cent of proteins; the greatest number of calories per pound.

NUTRIENTS FOUND IN ONE POUND OF SOME COMMON FOODS

Kind of food	Calories	Per cent of digestible nutrients			
		Water	Protein	Fat	Carbo-hydrates
Beef loin..........	1090	52.5	15.6	16.6	....
Leg of mutton.....	1475	51.2	14.6	14.0	....
Pork chops........	1535	41.8	13.0	23.0	....
Cured ham........	1875	34.8	13.8	31.7	....
Fresh mackerel	620	40.4	9.9	4.0	....
Oysters...........	230	88.3	5.8	1.2	3.3
Raw eggs	695	65.5	12.7	8.8	....
Whole milk	315	87.0	3.2	3.8	5.0
Butter............	3405	11.0	1.0	80.8	....
Corn meal........	1175	12.5	7.8	1.7	73.9
Wheat bread, white.	1180	35.3	7.8	1.2	52.0
Dried beans.......	1560	12.6	17.5	1.6	57.8
White potatoes	375	62.6	1.5	0.1	14.0
Apples	285	63.3	0.3	0.3	9.7
Bananas..........	445	48.9	0.7	0.4	12.9

2. Plan two days' meals to meet the above requirements.

3. Select food for a child's supper. Give reasons for your selections.

60. *Find the missing terms:*

1. Selling Price $260, Gain $10, Gain %?, Cost?
2. Cost $500, Loss 4 %, Loss ?, Selling Price?
3. Selling Price $450, Gain 12½ %, Gain ?, Cost?
4. Cost $640, Gain $80, Selling Price ? Gain % ?
5. Selling Price $660, Loss $60, Loss % ?, Cost ?
6. Loss $72, Loss 8⅓ %, Cost ?, Selling Price?

61. *Find the difference between:*

1. Nineteen thousand and nineteen ten-thousandths; and nine hundred eighteen and nine hundred eighteen hundred-thousandths.

2. Nine thousand ninety and nine thousandths; and eighty-two thousand eight and eighty-two thousandths.

3. Nine hundred ninety-nine thousand nine and nine thousand ninety-nine hundred-thousandths; and eight million eight thousand eight hundred eight and eight hundred eight ten-thousandths.

4. Six hundred thousand sixteen and six hundred-thousandths; and nine hundred sixteen and nine tenths.

62. *Write as fractional per cents:*

1. .005	4. .00½	7. .00125	10. .003⅓
2. .015	5. .0125	8. .0018	11. .006¼
3. .0015	6. .025	9. .002½	12. .007½

63. *Solve by short method:*

1. 192 is 24 % of what number?
2. 735 is 35 % of what number?
3. 1044 is 116 % of what number?
4. 960 is 48 % of what number?
5. 432 is 48 % of what number?
6. 867 is 17 % of what number?
7. 567 is 63 % of what number?
8. 413 is 59 % of what number?
9. 675 is 75 % of what number?
10. 928 is 29 % of what number?

64.* *The Keeping of a Personal Account.*

1. *For study.* Mrs. Elizabeth Conder, a dressmaker, keeps a book in which every cent earned and spent by herself is written down. At the end of each week she balances her account that she may know whether she has gained or lost during the week. She owns the house in which she lives and receives $15 a month rent from another small house. She clears from $20 to $25 a week by her work.

1920	ELIZABETH CONDER	Debit		Credit	
Jan. 1	Cash on hand	$125	75		
2	Groceries			$ 5	35
2	Light Bill			1	75
4	Tickets to Concert			1	00
	House rent	15	00		
5	Repairs on house			2	25
6	Laundry			1	50
7	Dry goods			3	85
	Cash from customers	25	00		
	Balance			150	05
		$165	75	$165	75
7	Balance forward	$150	05		

2. Continue Mrs. Conder's account for the following week.

3. Write out Amanda Williams's cash account for 1 week.

Receipts: Wages $8.50; birthday gift $5.

Expenditures: Car fare 60¢; lead pencils 10¢; candy 20¢; a blouse $1.98.

4. Continue Amanda's account for another week.

All cash and all money received is entered on the *debit* side of the account. The reason for this is that the person *has to account* for the way that money is spent.

All money paid out is entered on the *credit* side of the account.

The difference between the sum of all the debits and the sum of all the credits is called the *balance*. An account is said to be *balanced* when the two sides are added up and the debit side equals the credit side, the *balance* being entered on the smaller side; thus, when an account is balanced, *cash on hand* is entered on the credit side. *After* the account is balanced, cash on hand is then entered, in the new account, on the debit side.

5. Should the following items be entered as debits or credits?

1. Salary.
2. Doctor's bill.
3. Gifts of money.
4. Purchase of a book.
5. Receipt of money from customers.
6. Expense for a vacation.

6. If the balance appears on the debit side, is the person getting ahead or running behind?

Pupils should be encouraged to keep individual accounts, but for obvious reasons these should not be made public in the class. Discuss the advisability of a family's keeping an account of household expenses.

65. *Express decimally:*

1. 8%; $\frac{1}{8}\%$; $12\frac{1}{2}\%$.
2. 6%; $\frac{1}{6}\%$; 60%; $\frac{1}{16}\%$.
3. 25%; 2.5%; $2\frac{1}{2}\%$; $2\frac{1}{4}\%$.
4. $1\frac{1}{6}\%$; $11\frac{1}{6}\%$; $16\frac{2}{3}\%$; $116\frac{2}{3}\%$.
5. $1.0\frac{1}{2}\%$; $1.0\frac{1}{3}\%$; $1.0\frac{1}{8}\%$; $.0\frac{1}{8}\%$.
6. 150%; 15%; 1.5%; $.15\%$.

66. *Give answers in per cent. At sight.*

1. $.87 - \frac{3}{4}$
2. $\frac{3}{5} - .43$
3. $.82 - \frac{3}{5}$
4. $\frac{4}{5} - .37$
5. $.27 - \frac{1}{5}$
6. $\frac{5}{8} - .50$
7. $.16 - \frac{1}{8}$
8. $\frac{3}{8} - .29$
9. $.36 - \frac{1}{4}$

67. *Oral Problems.*

1. Of a farm of 480 acres, 30 acres were planted in corn. What per cent of the farm was in corn?

2. A man owes a debt of $500. How much should he pay at the end of 18 months to cancel the debt and pay interest at 6 %?

3. I sold furniture for $90, making a profit of 100 %. What was the cost of the furniture?

4. A boy is saving money to buy a bicycle which has been priced to him for $16.50. If he has $9.80, how much more does he need?

5. If 1½ pounds of tea cost $1.20, what will 3 pounds cost?   *ratio*

6. Of 50 words given out to spell, Mary had 47 correct. What per cent of the words did she misspell?

7. What is the cost of 25 pounds of tenderloin at 48 cents a pound?

8. Out of 560 votes cast at an election a certain candidate received 350 votes. What per cent of all the votes did he receive?

9. If a man gains 25 % on an article, the selling price is what per cent of the cost?

10. When 80 % of an acre yields 40 bushels, what is the yield per acre?

11. A grocer exchanged 48 pounds of flour at 10 cents per pound for eggs at 60¢ per dozen. How many dozen eggs did he receive?

12. A collector charges 3 % commission for collecting a bill of $600. How much does he pay over to his employer?

13. A dealer had 80 gallons of milk. He sold all but 20 % of it. How many quarts did he have left?

14. Find the interest on $350 for 6 months at 4 %.

15. After an increase of $5000 in a year, the sales of a business house amounted to $25,000. What were the sales the previous year? What was the per cent of gain?

16. In a certain township the tax was $0.028 on a dollar. What was the tax on a farm assessed at $10,000?

17. What per cent do I lose when I buy at 30 cents and sell at 15¢? What per cent do I gain when I buy at 15¢ and sell at 30¢?

18. How much is received for a crate of raspberries sold at 40¢ per quart? 1 crate = 24 quarts.

19. A collector charges 2% commission for collecting a bill of $85. How much does he pay over to his employer?

20. In how many days will 80,000 bricks be laid at the rate of 16 M. per day?

21. How much is the interest on $1500 for 60 days at 6%?

22. What is the commission on $5000 at $2\frac{1}{2}$%?

23. How much do I pay for $100 worth of hardware at 10% and 5% off?

24. How much do I pay for $100 worth of hardware at 15% discount?

25. A salesman received $1200 commission on sales amounting to $40,000. What was the rate of his commission?

26. What is the area of a triangular piece of ground if one side is 10 rods long and the second side which meets it at right angles is 8 rods long?

27. The Eiffel Tower in Paris is 300 meters high. What is its height in feet?

28. A New York dealer imported ten dozen pairs of kid gloves from France. What was the total cost if he paid 2500 francs for the gloves and 20% *ad valorem* duty?

29. How many cubic feet of air in a room 30 feet long, 20 feet wide and 15 feet high?

30. A dry goods merchant sold some ribbon at 4¢ per yard more than its cost and realized a profit of $12\frac{1}{2}$%. What was the cost of the ribbon?

68.* *Receipts.*

1. ·When James Murphy paid to Mrs. Elizabeth Conder $15 house rent, she gave him the following receipt:

$15.00   KANSAS CITY, MO., *January 28*, 1920.

                           Received of *James Murphy*

Fifteen 00/100 ⁓⁓⁓⁓⁓⁓⁓⁓ Dollars

for   rent   of   house,   *808   Susquehanna   St.*,
from *January 1* to *January 31*, 1920.

                                   Elizabeth Conder

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2. Mrs. Conder made out and receipted a bill to one of her customers containing the following items: For work $12; 3¾ yd. dress lining @ 60¢; 6 yd. velvet ribbon @ 75¢; 1 dozen buttons @ 90¢; findings $2. Duplicate her bill and receipt.

3. Imagine yourself a carpenter. Write out a receipt to your employer, Charles Sudlow, for 5½ days' work of 8 hours each at 60 cents an hour.

4. Charles Mills sold a second-hand dining room set to Noah Anglin for $65. Write the receipt.

5. Why is a receipt unnecessary when a debt has been paid by a check upon a bank?

69. *Find the value of:*

1. $(6\frac{2}{3} - 5\frac{1}{6}) \div (2\frac{1}{2} \times 3\frac{1}{3}) = ?$

2. $(12\frac{1}{2} \div 1\frac{1}{4}) + (7\frac{1}{2} \times \frac{2}{3}) = ?$

3. $(7\frac{1}{2} + 8\frac{1}{6}) \div (2\frac{5}{8} \times \frac{2}{7}) = ?$

4. $3\frac{1}{5} \times 2\frac{1}{2} + (3\frac{1}{2} \div 4\frac{2}{3}) = ?$

5. $(8\frac{3}{4} + 6\frac{1}{2}) \div (6\frac{7}{8} + 3\frac{8}{9}) = ?$

70. *Solve by short method. Prove.*

  1. 146 is 73 % of what number?

  2. 452 is 113 % of what number?

  3. 177 is 59 % of what number?

  4. 348 is 87 % of what number?

  5. 655 is 131 % of what number?

  6. 495 is 99 % of what number?

  7. 234 is 117 % of what number?

  8. 114 is 57 % of what number?

  9. 605 is 121 % of what number?

10. 366 is 61 % of what number?

71. *At sight:*

  1. $7.5 \div 3 = ?$ **5.** $.42 \div .14 = ?$ **9.** $70.8 \div .004 = ?$

  2. $25.6 \div 32 = ?$ **6.** $.0121 \div 11 = ?$ **10.** $2.4 \div .3 = ?$

  3. $.063 \div .07 = ?$ **7.** $10 \div .01 = ?$ **11.** $.01 \div 100 = ?$

  4. $46.5 \div .015 = ?$ **8.** $16.8 \div .021 = ?$ **12.** $.02 \div .005 = ?$

72. *Find the value of:*

1. $(2\frac{3}{4} \times 8\frac{8}{9}) \div (1 - \frac{4}{5}) = ?$ **6.** $(18\frac{2}{3} - 6\frac{1}{2}) \div (3\frac{1}{2} \times \frac{10}{21}) = ?$

2. $(\frac{2}{3} \times 6\frac{1}{8}) \div (6\frac{1}{8} \div \frac{5}{8}) = ?$ **7.** $(1\frac{2}{3} - \frac{3}{4}) \div (\frac{2}{5} \times 3\frac{1}{8}) = ?$

3. $(3\frac{1}{3} \times 2\frac{3}{4}) \div (7\frac{1}{3} - 4\frac{4}{15}) = ?$ **8.** $(\frac{7}{8} \times \frac{4}{5}) \div (2\frac{1}{3} - 1\frac{3}{5}) = ?$

4. $(1\frac{1}{2} \div 2\frac{2}{3}) \div (3\frac{1}{3} - 2\frac{3}{4}) = ?$ **9.** $(2\frac{2}{3} - 1\frac{3}{4}) \div (2\frac{3}{4} \times 1\frac{1}{3}) = ?$

5. $6\frac{1}{2} + (4\frac{3}{7} \times \frac{14}{31}) = ?$ **10.** $7\frac{5}{7} \times (1\frac{3}{4} - \frac{7}{8}) = ?$

73. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
989	787	988	866	868	985
589	979	977	999	557	755
779	889	767	779	467	564
788	697	886	487	593	936
598	676	998	479	588	878
955	669	899	669	689	972
399	558	549	688	599	929
787	678	378	299	898	768
908	597	788	698	989	956
679	989	897	978	689	868

74.* *Bank Discount — Introduction.*

See lesson on Interest, p. 28.

Banks are often willing to cash promissory notes. In such cases the interest is collected in advance and is called *bank discount*. The bank discount is deducted from the face of the note and the borrower receives the remainder, which is called the *proceeds*.

$500.00   *St. Louis, Mo., January 25,* 1920.

Sixty days after date I promise to pay to the *First National Bank, St. Louis, Mo., Five Hundred and 00/100 Dollars,* for value received.

                                 Albert Manning.

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1. *For study.* The First National Bank of St. Louis, to whom Mr. Albert Manning is favorably known, accepts his note of $500 for sixty days. He is charged a discount of 6%. What is the amount of the discount? How much money (proceeds) does Mr. Manning receive?

<div align="center">Solution</div>

$500 Face of the Note	$500 Face of the Note.
.01	5 Discount
$5.00 Bank Discount	$495 Proceeds
The discount was $5.	Mr. Manning received $495.

Make sure the class understands that .01 is the rate for 60 days ($\frac{1}{6}$ yr.) at 6%.

2. If you borrow $750 at a bank for 90 days, at 6%, what would be the discount? How much money will you actually receive from the bank? How much must you pay back?

Find the discount on each of the following:

3. A $300 note discounted for 90 days at 6%.

4. A $250 note discounted for 60 days at 4%.

5. A $600 note discounted for 30 days at 6%.

6. A $450 note discounted for 60 days at 5%.

7. *For study.* James Morrow held a note for $600 at 5% dated April 6, 1917, and due July 6, 1917. He discounted it at a bank May 6, 1917, at 6%. How much did Mr. Morrow receive?

<center>Solution</center>

$600.00 Face of the Note	$607.50 Due at Maturity
7.50 Interest for 3 months	.01
$607.50 Due at maturity	$6.0750 Discount (from date of discount to date of maturity)
	$607.50
	6.08
	$601.42 Proceeds

<center>Mr. Morrow received $601.42.</center>

8. Find the proceeds of a note for $540, dated November 14, 1918, and having 60 days in which to run, if discounted on the day on which it is made. Interest and discount at 6%.

9. Mr. Brewer sold his farm for $8500 taking a note due in 3 months with interest at 5%. He discounted the note at a bank at once. What did he get in cash for his farm? Discount 6%.

10. James Partlow bought a house and lot for $7800. He paid $5000 cash and gave a 6 months' note for the balance to Henry Snider, the owner. Mr. Snider immediately discounted the note at the bank at 6%. How much did he actually receive for his property? To whom does Mr. Partlow pay the face of the note when due?

Find the proceeds of the following notes:

	Face	Date	Time	Interest	Date of Discount	Rate of Discount
11.	$375	May 1	7 mo.	4%	November 1	6%
12.	$500	April 1	9 mo.	4½%	July 15	6%
13.	$650	July 1	3 mo.	5%	September 15	6%
14.	$300	March 1	6 mo.	7%	July 1	6%

75. *City Market.*

1. In November, a dealer bought a box of grapefruit from Florida. He paid $5.50 for the box. What is the per cent of gain on one grapefruit, if he sold at 10¢ each? There were 100 in a box.

2. Oysters are bought at $3 per gallon and retailed at an advance of 25 %. How much is gained on 4 gallons?

3. A fruit dealer sells a box of lemons for $12 and gains 20 %. There are 360 lemons in a box. What was the cost per dozen?

4. Three barrels of cranberries were bought at the rate of $15 a barrel and sold at 20¢ per quart. What was the per cent of gain on the three barrels? There are 100 quarts in a barrel.

5. If a bushel of corn is bought at $1.90 and made into 38 quarts of hominy, what is the per cent of gain if the hominy is sold at 8¢ per quart?

6. Mr. Huddleston sells 6 palms for $7.50 and makes a profit of 20 %. What was the cost of the palms?

7. A dealer bought 60 pounds of coffee at 30¢ a pound. What was the per cent of gain if he sold it for $24?

8. Gooseberries cost Mr. Walton 15¢ per quart. What does he gain on 10 gallons if his profit is 20 %?

9. What is the gain per cent if one buys 6 pounds of buckwheat flour for 35¢ instead of buying it at 7¢ straight?

10. What is the per cent of gain on 6 sacks of coffee, each containing 100 lb., when bought at 32¢ per pound and sold for $48 per sack?

11. A dealer buys fish in Seattle. What is the per cent of gain on a 23-pound halibut, which cost $3.45 and sold at 18¢ per pound?

12. Which is the better bargain: 36¢ a pound for lard or 12 pounds for $4? How much better?

13. Fifteen crates of Spanish onions are shipped to Mr. Brown, each crate containing 60 pounds. He buys at the rate of 8¢ per pound and sells at 9¢ per pound. How much does he make? What is his per cent of profit?

14. A dealer buys cocoanuts, 10 in a box, for $1.20. He sells for 15¢ each. What is his gain per cent?

15. Mr. Smith, a fruit dealer, buys ten crates of lemons. He pays $4.50 per crate and retails one half at 2 for 5¢ and the remainder at 25¢ per dozen. Each crate contained 360 lemons. What is his profit? What is his per cent of gain?

16. At another time he bought 16 crates of lemons at $7.50 per crate. He retailed at 3 for 10¢. These crates contained 300 lemons. What was his per cent of profit?

17. He buys 60 boxes of cocoanuts containing in all 1500 nuts. On these he made a profit of $15, which was a profit of $8\frac{1}{3}\%$. What was the cost price of the whole? What was the selling price of each?

18. Mr. Graham, a retail fish dealer in our city market, sells a 200-pound barrel of fish for $68. This is a profit of $6\frac{1}{4}\%$. What was the cost of the fish?

What per cent more expensive is:

19. Java coffee @ 60¢ than Mocha @ 48¢?

20. English Breakfast tea @ 90¢ than Oolong @ 80¢?

21. Creamery butter @ 63¢ than country @ 56¢?

76. *Find the bank discount at 6 % on:*

1. $1700 from March 24, 1919, to August 15, 1919.

2. $800 from October 1, 1918, to December 10, 1918.

3. $5000 from September 7, 1919, to December 23, 1919.

4. $475 from June 11, 1918, to August 12, 1918.

77. *Find the interest on:* (~~Cancellation~~)

1. $760, at 4 %, from July 3, 1919, to February 23, 1920.

2. $3280, at 4½ %, from July 6, 1917, to January 5, 1918.

3. $7650, at 7 %, from June 10, 1919, to October 1, 1919.

4. $3720, at 5 %, from October 12, 1919, to January 12, 1920.

5. $4250, at 3½ %, from May 16, 1919, to January 4, 1920.

Before solving, write I (integer) or F (fraction) to show whether the quotient in each of the following is an integer or a fraction:

1. $24 \div 4 = ?$	**6.** $24 \div \frac{1}{8} = ?$	**11.** $6 \div 24 = ?$
2. $4 \div 24 = ?$	**7.** $4 \div \frac{1}{8} = ?$	**12.** $24 \div \frac{1}{6} = ?$
3. $24 \div \frac{1}{4} = ?$	**8.** $\frac{1}{8} \div \frac{1}{24} = ?$	**13.** $\frac{1}{6} \div \frac{1}{24} = ?$
4. $4 \div \frac{1}{24} = ?$	**9.** $\frac{1}{24} \div \frac{1}{8} = ?$	**14.** $\frac{1}{24} \div \frac{1}{4} = ?$
5. $\frac{1}{4} \div 24 = ?$	**10.** $8 \div \frac{1}{24} = ?$	**15.** $24 \div \frac{1}{4} = ?$

78. *Written Dictation.*

1. $2.80 \div .04 = ?$

2. $\frac{1}{8} \% =$ what decimal.

3. At the rate of $27 a dozen, what will 8 silver tablespoons cost?

4. If I spend $6\frac{1}{4}$ % of my money, and have $30 left, how much had I at first?

5. A man bought some goods for $72 and sold them for $81. He gains what per cent?

79. *Find the cost at sight:*

Selling Price	Gain	Loss
1. $240	*a.* 20 %	*b.* 20 %
2. $150	*a.* $33\frac{1}{3}$ %	*b.* $33\frac{1}{3}$ %
3. $360	*a.* 25 %	*b.* 25 %
4. $630	*a.* $12\frac{1}{2}$ %	*b.* $12\frac{1}{2}$ %
5. $420	*a.* $16\frac{2}{3}$ %	*b.* $16\frac{2}{3}$ %
6. $143	*a.* $8\frac{1}{3}$ %	*b.* $8\frac{1}{3}$ %

80. *Oral Problems.*

1. A boy works on Saturday from 8 A.M. to 6 P.M. at 25¢ per hour with an hour off for lunch. How much does he earn?

2. A cow sold for $120. The profit was $40. What was the per cent of gain?

3. Sold an article for $2 and gained 100%. What did it cost?

4. If it takes ¾ of a yard of material to make one dust cap, how many can be made from a piece containing 24 yards?

5. What will the posts of a 50-foot fence cost at 33⅓¢ each if placed 10 feet apart?

6. An aviator estimated that he was ½ of a mile from the ground. What was his height in feet above the ground?

7. A grocer bought eggs at 36¢ per dozen and sold them at 6 for 21¢. What per cent did he make?

8. A number and ⅓ of the same number are 32. What is the number?

9. A certain school has 4 recitations of 45 minutes each in the morning, and 3 recitations of 35 minutes each in the afternoon. How many hours and minutes of recitation during the day?

10. On a certain day in January the thermometer registered 6 degrees below zero; by noon it had risen 22 degrees. What was the thermometer reading at noon?

11. A woman paid $0.96 for 6 oranges and 8 apples. The oranges were 8¢ each. How much did each apple cost?

12. What profit does a dealer make on 4 tons of coal which he buys at $8.40 and sells at $9.60 a ton?

13. I pay an agent $8 for selling a lot, which is a commission of 2%. Find the selling price.

14. By selling land at $90 an acre, a farmer lost 25%. How much had it cost?

81. *Written Problems.*

$\frac{7}{8}$

$\overline{100}$
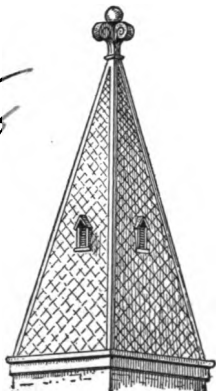
1. The four faces of a church spire are triangles. The base of each triangle is 18 feet and the altitude is 54 feet. How many square feet in each face? Each face equals two right triangles.

2. What will 20 bu. 2 pk. 5 qt. of clover seed cost at $6.40 per bushel?

3. 1694.229 ÷ 1.87 = ?

4. A workman earns $3.75 a day. He saves 20 % of it. How much will he save during the month of January, working six days a week? Five Sundays.

5. How many square feet of glass in a schoolroom lighted by 8 windows, each containing 2 panes of glass 47 by 36 inches?

6. A man leaves 50 % of his property to his wife, $33\frac{1}{3}$ % to his son, and the remainder to his daughter. The daughter receives $3000. What was the value of his property?

7. A man owns 150 acres of land. He planted .3 of it in wheat, .07 in corn, .375 in oats and the rest in grass. How many acres were in grass?

8. A room is 21 × 18 feet. Find the cost of carpeting it with strips a yard wide running lengthwise, at $1.30 a yard.

9. A plot of ground contains 30 square yards. It is 15 feet wide. How many feet long is it?

10. The wheel of a bicycle is 8.25 feet in circumference. How many times will it turn in going a mile and a half?

11. In a certain school are 800 pupils. This is 250 % of the number of boys in the school. How many girls in the school?

12. A family decides not to buy a refrigerator which would cost them $18. They find that they consequently use an extra pound of butter worth 55¢ each week because their butter becomes rancid. They are also obliged to throw away each week an average of 90¢ worth of other food which is spoiled. At the end of 20 weeks have they gained or lost by going without the refrigerator? How much? Allow 50¢ a week for ice.

13. How many yards of matting one yard wide must I buy for a room 15 feet wide and 18 feet long, the strips to run lengthwise? What will it cost at 65¢ a yard? Make a drawing.

14. The gable of a house is a triangle with a base 34 feet and altitude 11 feet. What is the area of the gable?

15. I wish to make a cement sidewalk 27 feet long and 9 feet 9 inches wide. What will it cost at 24 cents a square foot?

16. A commission merchant sells a lot of produce at 2% commission. If the amount of sales is $3250 and the expenses are $36.50, how much does he remit to the owner?

17. James E. Good, on Jan. 12, 1920, paid you $25 for one month's rent for a house at 5106 College Avenue. Write out the receipt for him.

18. Land costing $50,000 has recently been made an addition to the city. It has been graded and laid off into 150 lots at an additional expense of $25,900. If these lots sell at an average price of $600 each, what per cent of profit will the dealer make?

19. Bought groceries as follows: Nov. 12, 1919, 24 cans of corn @ 18¢; 3 bottles catsup @ 17¢; Nov. 21, ½ doz. cans peas @ $3.60; Dec. 10, 2 boxes breakfast food @ 15¢; 2 doz. oranges @ 35¢. Make out and receipt the bill.

20. What will be the cost of a piece of land 80 rods wide and 158 rods long, at $68 an acre?

21. On May 10, 1918, James Hughes borrowed of Hallam Jones $300, payable in 1 yr. with interest at 6%. On No-

vember 20, Mr. Jones discounted the note at a bank for cash at 6%. How much less money did he receive from the bank than was paid to the bank by Mr. Hughes?

22.† Make a drawing (scale $\frac{1}{16}$ in. to the foot) to represent a lot 64 ft. wide with a depth of 96 ft., on which a dwelling 32 ft. by 48 ft. has been placed 32 ft. from the sidewalk. A walk 4 ft. wide leads from the house to the sidewalk. Find the cost of cement work for the walk at 24¢ per square foot and of grading and sodding the lawn in front of the house at 25¢ per square yard.

23. The rate of taxation for all purposes in a city is $2.19 on the hundred dollars. Of this amount 61 cents goes to support the public schools. How much is paid toward the support of the schools by a man whose property is assessed at $2275?

24. Make a drawing of a two-inch square and one of two square inches. What is the difference between them?

25. Sixty pounds of soap are purchased at 20¢ a pound. In a damp cellar it absorbs water equal to $\frac{1}{5}$ of its weight and is then sold at 30¢ a pound. What is the gain? Per cent of gain?

26. With an average of 4.5 ft. below grade, what will it cost to fill a street 480 feet long and 80 feet wide at $67\frac{1}{2}$¢ a cubic yard?

27. A man earned $2400 in a year. He spent $\frac{1}{8}$ of it for fuel and light, .5 of the remainder for rent and other expenses and $5\frac{1}{2}$% of the balance for furniture. What did he save that year?

28. Mr. Ewing picked 40% of his strawberry crop and had 360 quarts left. What was the value of the entire crop at 25¢ a quart?

29. Find the interest on $750.75 at 5% for 5 mo. 10 da. Cancellation.

30. If an automobile uses $4\frac{1}{2}$ gallons of gasoline going 63 miles, how many miles does the car go on 36 gallons?

Test Page I

This page and the one following contain types of exercises which the class should do readily before proceeding to the work of Part II, Section One. A class percentage of not less than eighty should be required.

I

Write answers only:

1. $8\frac{1}{3}$% of 96 is $66\frac{2}{3}$% of what number?

2. $\frac{7}{8}$% = what decimal?

3. Find the interest on $300 at 6% for 1 yr. 6 mo.

4. What will a bill of goods listed at $80 cost if the discount is $12\frac{1}{2}$%?

5. By selling a suit for $21, a dealer made $3. What was the per cent of gain?

Show all work — time limit 25 minutes:

1. A book agent sold 84 books at $3.50 each. After deducting his commission, he remitted $176.40 to the publishers; what was the rate of his commission?

2. What is the tax on property the assessed valuation of which is $15,400, if the rate of taxation is $2.69 on the $100?

3. On October 16, 1917, William Sloan borrowed $1345.50 at 4%. Find the amount due May 14, 1918. Cancellation method.

4. A resident of the city, giving up his lease on an apartment at $50 per month, bought a lot for $1600 and built a house for $4000. The taxes on the place are $44 a year, the cost of repairs $30, and of insurance $12. If money is worth 6% interest, how much does the man save in a year by owning his own house?

5. A woman sold a coat for $90 which was $6\frac{1}{4}$% less than cost. What was the cost?

Test Page II

III

Oral Problems.

Before solving, name the operations to be used in the problem.
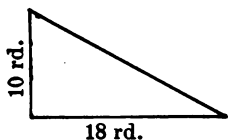
1. How many square rods in this field?

10 rd.

18 rd.

2. A jeweler sold a watch for $72, thereby gaining $33\frac{1}{3}$%. Find the gain and cost.

3. If $40 is $62\frac{1}{2}$% of my money, how much money have I?

4. An agent collected a debt of $560. His commission was $70. What was the rate of commission?

5. From a pile of wood containing 30 cords, 25 cords are sold. What per cent remains unsold?

IV

Write at dictation:

1. *Add:* 9.76 + 89 + 786.5 + 9.839 + 78.687 + 567.788 + 69.79 (⬛⬛⬛⬛⬛).

2. *Find the difference between:* 87,694$\frac{2}{3}$ and 79,897$\frac{1}{4}$ ⬛⬛⬛⬛).

3. *Multiply* 89.0465 by 67.08 ⬛⬛⬛⬛⬛⬛.

4. *Divide* 6303.26446 by .894 (⬛⬛⬛⬛⬛).

5. $(6\frac{2}{3} + 1\frac{1}{5}) - (7\frac{1}{2} \times \frac{2}{3}) = ?$ (⬛⬛⬛⬛⬛).

V

Each child one exercise: (oral)

1. 3.6 ÷ 1.2 = ?
$\frac{1}{8}$% = what decimal?
72 is 9% of ?
81 is $112\frac{1}{2}$% of ?

2. .28 + 1.4 = ?
48 is 8% of ?
$\frac{3}{8}$% = what decimal?
36 is 120% of ?

3. 49 is what % of 42?
$\frac{1}{16}$% = what decimal?
63 is $116\frac{2}{3}$% of ?
3.2 ÷ .16 = ?

4. 3.5 − .7 = ?
24 is 3% of ?
24 is what % of 3?
$\frac{3}{4}$% = what decimal?

PART II — SECTION ONE

1. *Economy in Good Roads.*
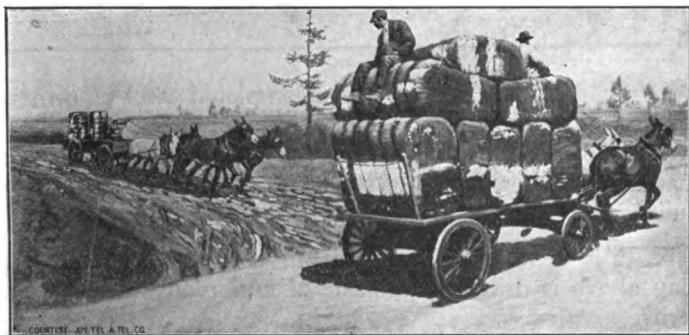
1. Two mules can haul 8 bales of cotton over a macadamized road when it requires four mules to haul 2 bales over a poor dirt road. The amount of cotton hauled by one mule in the first team is what per cent of the amount hauled by one mule in the second team?

2. Mr. Walter Evans bought a farm in Virginia containing 50 acres for $4800. Three years later, because of improved roads, he was able to sell it at $132 an acre. What was the per cent of increase in value?

3. It is estimated that, in 1916, thirty-five thousand persons drove across the United States into California. This was an increase in two years of 600 %. How many persons had made the same journey in 1914?
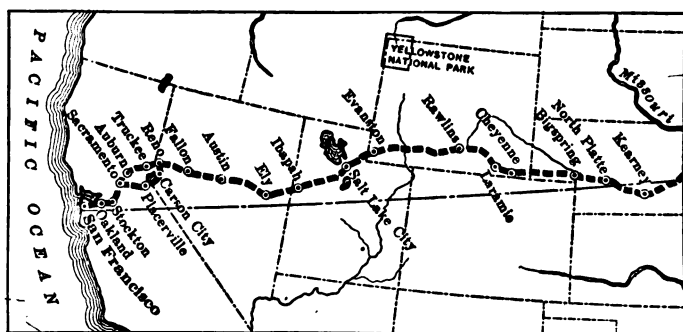
4. The Lincoln Highway when completed will be a cement roadway extending from New York to San Francisco, a distance of 3330 miles. What will it cost to complete the road at an average cost of $16,000 a mile if 75 % of it is now built?

5. It is 285 miles from Pittsburgh to Lima, Ohio. The map above is drawn on a scale of how many miles to the inch?

6. In 1916 the federal government appropriated $75,000,000 to be used for post roads throughout the country during the ensuing five years. However, before any state could receive its apportionment, it must have raised a similar amount under a state highway commission. If all of the states had responded, how many miles of post road would have been built between the years 1916 and 1921 at an average cost of $12,000 a mile?

7. In five backward states in which but 3 % of the roads are improved, only 59 % of the pupils enrolled attend the public schools regularly. In five other states in which 39 % of the roads are improved, 77 % of the pupils enrolled attend regularly. Each per cent of increase in school attendance would seem to be accomplished by what per cent of increase in road improvement? Make a graph.
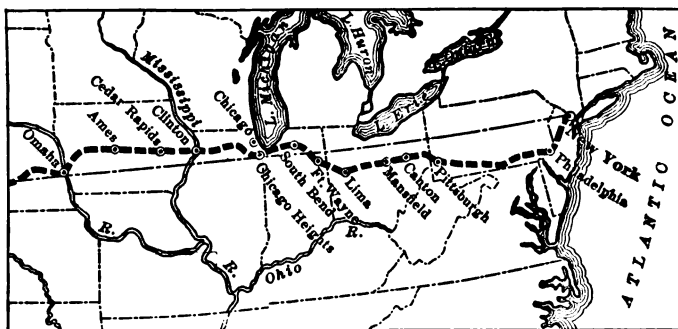
8. In 1912 the United States expended $43,000,000 in road building and in 1915, $215,000,000. What was the per cent of increase?

9. In a certain year the Interstate Commerce Commission showed that the railroads handled 820,000,000 tons of freight. About 80 % of this was hauled over country roads at an average cost of 23¢ a ton per mile. What was the cost of the road hauling?

10. It is estimated that in Europe the average cost of hauling is only 10¢ per mile. What should we save in handling 820,000,000 tons of freight if we so improved our roads that we could haul freight at 10¢ a ton per mile?

11. There are 2,150,000 miles of road in the United States. What will it cost to macadamize 60 % of this total at an average cost of $5000 a mile?

2. *Solve by cancellation:*

1. $\frac{4}{7} \times 4\frac{2}{3} \times \frac{12}{18} \times \frac{6}{40}$

2. $1\frac{2}{3} \times 2\frac{1}{4} \times 1\frac{1}{18} \times \frac{5}{12}$

3. $1\frac{3}{4} \times \frac{10}{14} \times 5\frac{1}{7} \times 1\frac{6}{15}$

4. $4\frac{1}{2} \times 1\frac{6}{12} \times \frac{16}{27} \times 1\frac{18}{36}$

5. $3\frac{2}{3} \times \frac{9}{22} \times \frac{8}{45} \times 1\frac{4}{56}$

6. $5\frac{2}{3} \times \frac{12}{34} \times \frac{5}{28} \times \frac{7}{40}$

7. $6\frac{2}{3} \times \frac{12}{5} \times \frac{15}{24} \times \frac{24}{7}$

3. *Find the value of:*

   1. $4\frac{1}{2} \div 3\frac{3}{4} + 7\frac{1}{2} - 6\frac{2}{3} \times \frac{4}{5} = ?$

   2. $8\frac{1}{6} \times 4\frac{1}{7} + 2\frac{1}{2} \div \frac{2}{6} = ?$

   3. $5\frac{1}{3} \times 2\frac{5}{8} - 2\frac{1}{7} \div 7\frac{3}{8} = ?$

   4. $5\frac{2}{3} \times 6\frac{2}{3} - \frac{3}{4} \div \frac{7}{16} = ?$

4. *At sight:*

   1. 24 is what per cent of 32? Of 64? Of 480? Of 16? Of 36?

   2. 20 is what per cent of 50? Of 120? Of 24? Of 16? Of 32?

   3. 42 is 6 % of what number? 7 % of what? 21 % of what? 14 % of what?

   4. 48 is 16 % of what? $66\frac{2}{3}$ % of what? 120 % of what? 75 % of what?

5. *Written Dictation.*

   1. $16\frac{2}{3} \times 3 = ?$

   2. Write in Roman numerals: 499.

   3. A grocer having $4\frac{1}{2}$ crates of berries sold $\frac{1}{2}$ of them. How many had he left?

   4. How much picture molding is needed for a frame $9\frac{7}{8}$ inches long and $4\frac{1}{4}$ inches wide?

   5. A man sold a horse for $180, thereby gaining $12\frac{1}{2}$ %. For how much did he buy the horse?

6. *Add:*

1.	2.	3.	4.	5.	6.
868	786	768	978	997	999
788	568	959	244	899	697
979	697	889	975	588	868
899	358	569	846	877	887
596	987	497	935	686	686
479	999	596	579	948	359
768	889	477	645	487	679
	978	888	476	678	477
	379	997	986	379	788
888	886	889	885	589	798

7. *Written Problems.*

1. ·On June 10, 1917, William Chandler loaned his brother Samuel $240, payable on demand with interest at 6 %. The note was paid December 20, 1917. Make out the note in proper form and find the amount due at the time of payment.

2. What tax does a man pay whose property is assessed at $1850, if the tax rate is $2.18 per $100, and if he also pays a poll tax of $2?

3. Under the tariff law of 1908˙ the duty on carpets woven whole is 10¢ per sq. ft. and 40 % *ad valorem.* What will be the total cost including duty of an imported drugget 9 × 12 ft. invoiced at $120?

4. A young man who is working his way through college makes $25 a week by outside work during the entire year. His living expenses are $15 a week. Other expenses are $260. What does he clear above expenses?

5. A farmer sold 32 hogs, average weight 285 lb., at $21.50 per hundred pounds and 20 hogs, average weight 312 lb., at $19.75 per hundred pounds. How much did he receive for all?

6. Find the cost of excavating a cellar 28 ft. long, 16 ft. wide and 7 ft. deep at $1.50 per cubic yard.

7. How much will it cost to cement the floor of the cellar described in problem 6 at 24 cents per square foot?

8. A note for $540, payable in 90 days, without interest, and dated June 24, was discounted August 1, 1919, at 6 %. What was paid for the note?

9. A class of girls made 5 bags, 8 calendars, and 7 letter cases. Each bag required 18 in. of ribbon; each calendar 9 inches; and each case 20 inches. What did all of the ribbon cost at 4½¢ a yard?

10. What are the taxes of a man whose real estate is valued at $6500 and personal property at $600, if the rate of taxation is $2.25 on the $100?

11. A piece of cloth 20 yards long measured 19.5 yards after being sponged. What was the per cent of loss due to shrinkage?

12. A farmer sold 4200 pounds of wool or 70 % of his entire shearing at 45¢ a pound. The remaining portion he sold at 60¢ a pound. How much did he realize from his whole shearing?

13. The rate of taxation in a certain city is $2.18 on each one hundred dollars. How much tax will a citizen pay whose real estate is assessed at $5400, his personal property at $1435 and whose poll tax is $2?

14. How many cubic feet of oxygen are there in a room 32 × 28 × 11 feet, when oxygen is 20 % of all the air?

15. A grain dealer paid his agent $71.28 commission for buying corn. The rate of commission was 1½ %. How much money was spent for corn?

16. Two boys worked 4 days of 8 hr. each making a canoe. The materials cost $23. They sold the canoe for $40. How much did each receive an hour for his work?

17.

$525.   CHICAGO, ILLINOIS, *March 1, 1920.*

Ninety days after date I promise to pay to *G. E. Emerson,* or order, *five hundred twenty-five dollars,* for value received.

                                        E. M. Addison.

Who is the maker of this note? If the note should be discounted at 6 % on the day it was made, how much would the proceeds be? To whom would the proceeds be paid?

18. 7 qt. is what part of 2 pk. 5 qt.?
      2 pk. 5 qt. is how many times 7 qt.?
      7 qt. is what per cent of 2 pk. 5 qt.?
      2 pk. 5 qt. is what per cent of 7 qt.?

8.* *Ratio and Proportion.*

> The relation one number bears to another is called the *ratio* of that number to the other. The ratio of 3 to 6 is $\frac{1}{2}$. The ratio of 6 to 3 is ——.
>
> The first term in a ratio is called the *antecedent* and the second is called the *consequent.*
>
> The sign : is read "is to." It is equivalent to the sign of division.

1. *For study.* Tom paid $120 for a pony and a cart. The pony cost $80. What part of the whole cost was that?

Solution by Unitary Analysis	Solution by Ratio
$1 = \frac{1}{120}$ of $120	$80 + $120 = $\frac{80}{120}$ or $\frac{2}{3}$
$80 = 80 × $\frac{1}{120}$ of $120 = $\frac{80}{120}$ or $\frac{2}{3}$ of $120.	

The cost of the pony was $\frac{2}{3}$ of the whole cost.

2.
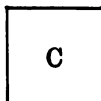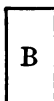
a. How many times greater than *a* is *b*? What part of *b* is *a*?

b. What is the ratio between *a* and *b*? Between *b* and *a*?

c. How many times is *b* contained in *c*? What part of *c* is *b*?

d. What is the ratio between *b* and *c*? Between *c* and *b*?

e. What is the ratio between *a* and *c*? Between *c* and *a*?

3. I traveled in my automobile 60 miles on Monday and 75 miles on Tuesday. What was the ratio (relation) of Monday's trip to Tuesday's? Continue.

Read the Preface and the Table of Contents. Lessons marked * should be assigned for study previous to the recitation. See Suggestions to Teachers.

A proportion is the expression of the equality of two ratios. $1:3 = 4:12$. The sign = is read "as."

The first and last terms in the proportion are called the *extremes*. The middle terms are called the *means*.

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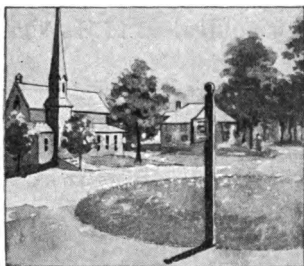
4. * *For study.* When a post 12 feet high casts a shadow 4 feet long, how long a shadow will a neighboring church steeple cast which is 120 feet high?

Two Solutions

a. 12 ft.:120 ft. = 4 ft.:? ft.
$\frac{12}{120} = \frac{4}{40}$ (ratio = $\frac{1}{10}$)

b. 120 ft.:? ft. = 12 ft.:4 ft.
$\frac{120}{40} = \frac{12}{4}$ (ratio = 3)

The church steeple will cast a shadow 40 feet long.

The following problems should be solved by obtaining *equal ratios*. Do not anticipate solution found on page 160.

5. Mr. Ward bought a pile of wood containing 12 cords for $45. He purchased another pile containing 60 cords at the same rate. How much did he pay for it?

6. What must be paid for 2 dozen bananas selling at 3 for 10¢?

7. If a manufacturing plant makes 900 pins in 2 minutes, how many pins will it make in 10 minutes?

8. When 4 pounds of butter cost $1.40, what is the cost of 5 pounds at the same rate?

9. What is the cost of 3 acres of land when 5 acres cost $275?

10. How much must be paid for 18 tulip bulbs selling at 72¢ a dozen?

11. If the interest on a sum of money for 6 months is $18, what is the interest for 8 months at the same rate?

9. *Written Problems.*   Solve as many problems as possible by proportion.

1. If two yards of silk cost $3.50, how many yards can be bought for $14?

2. A merchant sold a lot of damaged sugar at a loss of 25 per cent, receiving $168.54. How much did the sugar cost him?

3. A yachting party sails 375 miles in 15 days. At the same rate, how far will it travel in a 90-day trip?

4. A man left for charitable purposes $7200, which was $37\frac{1}{2}$% of his money. The remainder was divided equally among 5 relatives. How much did each relative receive?

5. If 3 packages of paper cost $5.25, what will 12 packages cost?

6. If Henry who is 5 feet 6 inches tall casts a shadow 5 feet long, how high is a tree that casts, at the same time, a shadow 42 feet long?

7. A schoolroom is 27 ft. wide, 30 ft. long and 15 ft. high; the area of one end wall is what per cent of the area of one side wall?

8. What amount of money will settle an account of $580 that has been drawing interest for 3 years 7 months 15 days at 5 per cent?

9. How many pounds of tallow must be mixed with 15 pounds of rosin in order that the mixture may contain $16\frac{2}{3}$% tallow?

10. Make a bill for material which a teacher of sewing ordered at the beginning of this term. There were 18 girls in the class and she ordered the following for each: $2\frac{1}{2}$ yards sateen at 22¢; $1\frac{1}{2}$ spools of thread at 5¢ a spool; $1\frac{3}{4}$ yards of elastic at 4¢; 1 doz. buttons at 15¢ a dozen.

11. A jeweler bought a ring for $112 or $12\frac{1}{2}$% less than its value. If he sold it for $12\frac{1}{2}$% more than its value, at what price did he sell it?

12. What are the proceeds on a note for $1150 discounted at a bank for 60 days at 6%?

13. Five clerks use 225 sheets of paper in a day. At the same rate, how many sheets will 9 clerks use?

14. A bill of hardware amounting to $4500 was sold June 24 at a discount of 20 % and 12½ %, with a further discount of 10 % if paid within 30 days. What sum will pay the bill on July 15, the same year?

15. A miller uses 18 bushels of wheat for making 4 barrels of flour. How many barrels of flour can he make from 144 bushels?

16. A merchant bought goods for $245 and sold them at an advance of 12 %, receiving in payment a 60-day note for the amount. He had the note discounted the same day at a bank at 6 %. What did he receive for it?

17. Albert Bristor spent $360 during his first term at college, which was 45 % of his year's allowance. What was his year's allowance and what had he left for the remainder of the year?

18. A man paid $190 for 20 tons of coal. At the same rate, what should he pay for 15 additional tons?

19. S. H. Peterson bought 36 head of cattle at $90 a head. After losing 2 of them, he sold the remainder at $130 per head. What was his per cent of profit?

20. If Charles Denny can make 12,600 peach baskets in 6 weeks, how many baskets can he make in 45 weeks?

21. What is the freight on 7600 pounds of iron at $1.86 per ton?

22. When 54 acres yield 186 tons of hay, how many tons should 81 acres produce at the same rate?

23. An automobile sold for $900. This was a loss of 6¼ %. What had been the cost?

24. Find the cost of 85 yards when 5 yards cost $1.35.

25. What per cent is gained in buying oil at 80¢ a gallon and selling it at 12¢ a pint?

10. *A Short History of Arithmetical Numeration and Notation.*
Before men could read and write they counted on their
fingers. When they wished to remember they kept tally
by means of piles of stones and by making strokes on rocks.
For example, a man would show that he had sold 10 sheep
in this way: ⁄⁄⁄⁄ ⁄⁄⁄⁄ . Later the Egyptians in-
vented ⁄⁄ to stand for 10. They represented 12 by ⁄⁄⁄⁄ .
How did they represent 21? 52?

In almost all savage tribes counting is done by aid of the
fingers and occasionally by use of all the fingers and toes.
Consequently, it will be seen that the first number groups
were fives, tens or twenties. Some tribes count to five which
represents the number of fingers on one hand and count six as
"hand one," seven as "hand two"; ten as "both hands";
twelve as "two on the foot"; twenty as "the whole man";
sixty as "three men"; etc. Counting by means of the fingers
has been general with all ancient peoples. The Greeks
could indicate numbers up to 10,000 on the hand by using
the separate joints of the fingers. It is said that the Chinese
to-day can express 100,000 on the left hand alone, by using
the two sides and the front of each finger joint as symbols.

Our system of notation is often called the Arabic system
because the Arabs introduced it into Europe, but it is be-
lieved that the Hindoos invented the figures 1, 2, 3, 4, 5, 6, 7,
8, 9. We call these nine figures *digits* from a Latin word
meaning finger. The 0 symbol was probably invented
about 400 A.D. It is one of the greatest inventions of all
time, for by it the principle of *place value* was first employed
in a scientific way, making it possible to represent any
number with the use of zero and the nine digits. Because
10 forms the basis of this place value in our notation, we
also call our system the decimal system from the Latin
word *decem* meaning "ten."

The Italians invented the word *million* about one hundred
years before Columbus came to this country. The French
invented the words *billion* and *trillion* in the sixteenth
century.

1. *a.* On the schoolroom floor lay papers to represent the following numbers, using a quarter inch square to represent 1.

d	*c*	*b*	*a*
1000	100	10	1

The number you have represented is ——.

See that the class has plenty of time to realize our great indebtedness to the peoples who invented the cipher, and made notation by means of place possible. The pupil will have no mathematical experience that will outrank this in value. Where squared paper is not available, have pupils rule plain manila. All pupils in the class should assist.

b. Using the quarter inch square to represent 1, what would be the size of the surface covered by 10,000 such squares?

c. If by fast writing you can make four figure 1's in a second, how long would it take you, had you the strength to keep it up, to make 100,000 figure 1's? How long does it take to represent the same number by the use of the decimal system?

For convenience in reading and writing large numbers, the figures are separated by commas into groups of three, called periods. Each period beginning at the left is read with its name as if it stood alone. The name of the units period is omitted. The word "and" is reserved for the decimal point.

Hundred-billions Ten-billions Billions	Hundred-millions Ten-millions Millions	Hundred-thousands Ten-thousands Thousands	Hundreds Tens Units	Tenths Hundredths Thousandths Ten-thousandths Hundred-thousandths Millionths
2 4 0 ,	0 8 0 ,	0 0 0 ,	4 3 8 .	7 3 2 5 7 9

2. How do we read 3096 when it is a telephone number? To save time, it is customary with people who are dealing with many numbers to read 356.42 as "Three five six point four two."

11. ~~Problems on Thrift — Oral.~~

Why was the picture of the Wool-
worth Building (erected by the man
who originated the five and ten-
cent stores) chosen for this page?

1. A saving of 5 cents daily for
one year is 5 % interest on what
sum?

2. Make original problems to
illustrate:

a. "Dost thou love life? Then do not
squander time, for that is the stuff that
life is made of." — Franklin.

b. Annual income, twenty pounds.
Annual expenditures, nineteen six. Re-
sult, happiness.

Annual income, twenty pounds. Annual expenditures, twenty
pounds, naught and six. Result, misery. — Dickens.

3. The invention of the sewing machine reduced the cost
of the factory product to one fourth that of the hand-stitched
garment. Each kind of garment cost what per cent of the
other?

4. One man with a cotton gin can clean 1000 pounds of
cotton in one day in place of 5 pounds formerly cleaned by
hand. The man with the gin releases how many men for
other work?

5. Of 27,000 (approximately) people who died in New
York County one year, 83⅓ % died without leaving an estate.
How many persons left estates? What is your judgment
on this?

6. A boys' club decided to wear overall suits to school.
During the year each boy bought three $4 suits, thereby
saving the purchase of one $25 cloth suit. What per cent
did he save?

12. *Roman Notation.*

In addition to the Arabic system we use still another system of counting called the Roman system because of its origin among the Romans.

The Roman notation uses seven letters, namely:

I	V	X	L	C	D	M
1	5	10	50	100	500	1000

1. Name three places where Roman numerals are often used.

2. When a letter is repeated, its —— is repeated. Illustrate.

3. When a letter is placed after another letter of greater value, its value is to be —— to that of the greater letter. Illustrate.

4. When a letter is placed before another letter of greater value, its value is —— from that of the greater letter. Illustrate.

5. A letter between two letters, each of which is greater than itself, is regarded as preceding the —— letter. Illustrate.

6. A bar (or dash) placed over a letter increases its value one thousand-fold. $\overline{M}$ = ?

7. Why do we use the Arabic system rather than the Roman system for all computations? Multiply CIV by XXVII; 104 by 27.

8. Read the following:
a. XVI, XXXII, XLI, XCII, LXXXVI.
b. CLX, CCLXX, DC, DCCL, MDCCC, CD.
c. $\overline{D}$, $\overline{D}$CCCL, MC, CM, LXIX, MCD.

13. *Solve by cancellation:*

1. $3\frac{1}{5} \times 2\frac{5}{8} \times 1\frac{7}{8} \times 1\frac{1}{7} \times \frac{5}{9} \times \frac{1}{10}$ = ?

2. $6\frac{2}{3} \times \frac{6}{15} \times \frac{3}{16} \times \frac{4}{18} \times 3\frac{3}{7} \times 2\frac{5}{8}$ = ?

3. $2\frac{1}{4} \times 5\frac{1}{3} \times 1\frac{7}{8} \times 1\frac{3}{5} \times \frac{16}{21} \times \frac{7}{24}$ = ?

4. $3\frac{1}{9} \times 2\frac{1}{12} \times 1\frac{1}{5} \times \frac{3}{7} \times 1\frac{1}{10} \times \frac{1}{9}$ = ?

5. $3\frac{3}{5} \times 4\frac{1}{8} \times 1\frac{4}{5} \times 1\frac{1}{9} \times \frac{7}{15} \times \frac{5}{6}$ = ?

14. *At sight:*

1. $4:6 = 8:?$	**11.** $4:5 = 8:?$	**21.** $8:6 = 4:?$
2. $5:15 = 12:?$	**12.** $4:5 = 12:?$	**22.** $15:12 = 5:?$
3. $9:12 = 12:?$	**13.** $3:4 = 12:?$	**23.** $24:36 = 12:?$
4. $7:21 = 11:?$	**14.** $5:6 = 25:?$	**24.** $21:18 = 7:?$
5. $6:8 = 9:?$	**15.** $6:9 = 2:?$	**25.** $18:24 = 9:?$
6. $5:8 = 10:?$	**16.** $7:8 = 56:?$	**26.** $8:2 = 6:?$
7. $7:9 = ?:27$	**17.** $3:4 = ?:20$	**27.** $8:12 = ?:48$
8. $2:3 = 16:?$	**18.** $6:8 = 36:?$	**28.** $15:18 = 30:?$
9. $6:7 = ?:21$	**19.** $5:6 = ?:24$	**29.** $24:5 = 48:?$
10. $25:45 = 75:?$	**20.** $4:5 = 16:?$	**30.** $9:10 = ?:30$

15. *Find the interest on:*

1. $350, at 6 %, from Jan. 16, 1919, to December 6, 1920.

2. $720, at $4\frac{1}{2}$ %, from Feb. 10, 1914, to Oct. 3, 1917.

3. $480, at 5 %, from March 18, 1916, to May 5, 1917.

4. $510, at $3\frac{1}{2}$ %, from April 12, 1914, to Dec. 4, 1918.

5. $840, at $5\frac{1}{2}$ %, from August 15, 1914, to Oct. 2, 1916.

6. $960, at $7\frac{1}{2}$ %, from May 25, 1918, to July 9, 1920.

16. *Find the value of:*

1. $(3\frac{1}{3} \times 7\frac{1}{2}) \div (9\frac{2}{7} \div 2\frac{1}{2}) = ?$

2. $6\frac{1}{4} - (2\frac{1}{2} \times \frac{3}{8} + 8\frac{1}{3} \div 3\frac{1}{2}) = ?$

3. $(7\frac{1}{2} \div 2\frac{1}{3}) + 3\frac{1}{2} \times 4\frac{1}{5} = ?$

4. $(6\frac{2}{3} \div 2\frac{1}{2}) \times (1\frac{2}{3} \div 3\frac{1}{3}) = ?$

17. *Find the product:*

1. $8.04 \times 6.375 = ?$

2. $80.7 \times 7.6 = ?$

3. $9.06 \times 67.04 = ?$

4. $7.08 \times 8.04 = ?$

5. $9.078 \times 7.09 = ?$

6. $9.06 \times 7.89 = ?$

7. $6.78 \times 87.07 = ?$

8. $80 \times 7.06 = ?$

18. *City Milk Business — Written.*
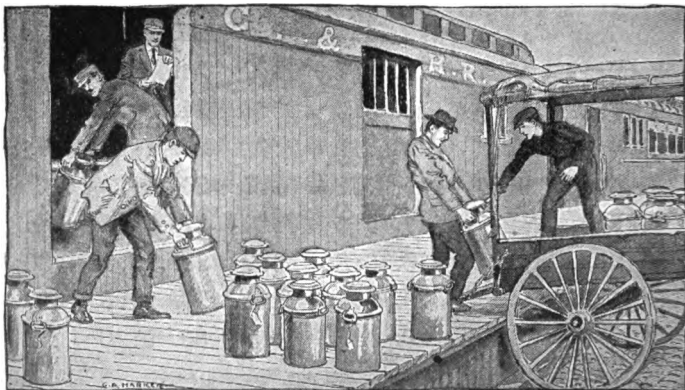
1. On July 7, the Renard Milk Company bought 10,000 gallons of milk from 100 dairies. If a gallon of milk weighs 8.6 pounds, what was the average weight of the milk bought from each dairy?

2. The milk yielded 3440 pounds of butter fat. This was 4 % of the weight of the milk. How much did the milk weigh? How do problems 1 and 2 check each other?

3. How much would the Renard Milk Company have paid for the butter fat at 51¾¢ a pound?

4. The traction company charged for shipment according to the distance. What did the Renard Milk Company pay for shipping:

> First zone, 2000 gallons at 1¾¢ a gallon.
> Second zone, 4000 gallons at 2¼¢ a gallon.
> Third zone, 4000 gallons at 2¾¢ a gallon.

5. The company reserved 14,000 pounds of milk from which butter was made. The butter weighed 5 % as much as the milk and was sold at 60¢ a pound. How much did the company realize from the sale of butter?

6. The total cost of the milk for one day (including pasteurizing, bottling, etc.) was $2260. The company realized a profit of $158.20. What was the per cent of profit?

7. Through breakage or failure to return, 2100 bottles were lost that day. This was 3 % of the total number of bottles used. How many bottles were used? What was the total loss if each bottle cost the company $3\frac{1}{2}$¢?

8. Make out and receipt a bill for the daily feed of the company's 120 horses: 630 lb. of corn at $1.70 per bu.; 2400 lb. of hay at $32 per ton; 480 lb. of oats at $.76 per bu.; 200 lb. of stock feed at $46 per ton; 400 lb. alfalfa at $60 per ton. 70 lb. of corn and 32 lb. of oats = 1 bushel each.

9. It is estimated that one large city in the United States would save at least $500,000 yearly if the distribution of milk were organized under a system. For example: 17 different milkmen supply 38 homes on Griffith Street and travel 4 miles in doing so. One distributor could deliver the milk to all these homes and travel less than $\frac{1}{2}$ of a mile. What equipment would be needed under a model system according to the following table, the model system being a per cent of the present system:

THE COST OF DISTRIBUTING MILK

Under Present System	Under Model System
360 men......................................	25 %
400 horses....................................	30 %
300 wagons...................................	9 %
300 miles of travel............................	10 %
$7600 in milk room equipment..................	52 %
$108,000 in horses and wagons.................	35 %
$2,000 daily cost of distribution...............	30 %

10. How much money, which is now spent in the daily distribution, would be saved under the model system? The model system would be what per cent of the cost of the present system?

11. Can you think why it would be incorrect to average the various per cents found in problem 9 under "Model System" in order to obtain the answer for problem 10?

19. *Oral Problems.*   Solve as many problems as possible by proportion.

1. If $1200 yield $240 interest in a certain time, what interest will $900 yield in the same time and at the same rate?

2. If you buy for $⅓ and sell for $½, what is the per cent of gain or loss?

3. If 25 gallons of distilled water last a hospital 5 days, how long will 125 gallons last?

4. At 1½ % what is the commission of an agent who buys $2000 worth of wool?

5. A dozen chairs cost $48.   What would 8 chairs cost at the same rate?

6. I sold a watch for $84 and gained 16⅔%.   What should I have gained or lost if I had sold it for $60?

7. A tree 50 ft. high casts a shadow 10 ft. long.   A neighboring building 250 ft. high will cast how long a shadow at the same time?

8. I paid my agent a commission of 2% for selling a farm for $1500.   How much money did he send me?

9. A 5 % increase in wages means $35 more a month for an employer to pay.   What has been his pay roll?   What will it be after the increase?

10. Find the cost of painting the walls of a room 21 feet long, 15 feet wide and 10 feet high at 40¢ a square yard. No allowance for openings.

11. I paid $19 for 2 tons of coal.   What should I pay for 5 tons at the same rate?

12. How much will I have left from $5 after paying $1½ for a pair of house shoes and $0.75 for a pair of gloves?

13. The ratio of the height of a schoolroom to its width is ⅗.   The width is 30 ft.   What is the height?

14. Mr. Allison paid $200 for his passage from Liverpool to New York and 45 % as much for his railway fare home. How much did he pay for both tickets?

20. *Complete:*

1. $\frac{4}{7} = \frac{?}{21}$	8. $\frac{6}{13} = \frac{24}{?}$	15. $\frac{?}{9} = \frac{42}{54}$
2. $\frac{7}{?} = \frac{28}{72}$	9. $\frac{8}{12} = \frac{?}{36}$	16. $\frac{5}{?} = \frac{25}{60}$
3. $\frac{16}{17} = \frac{80}{?}$	10. $\frac{?}{3} = \frac{5}{15}$	17. $\frac{3}{?} = \frac{24}{56}$
4. $\frac{4}{9} = \frac{28}{?}$	11. $\frac{9}{?} = \frac{27}{33}$	18. $\frac{7}{12} = \frac{?}{72}$
5. $\frac{3}{4} = \frac{9}{?}$	12. $\frac{4}{?} = \frac{?}{30}$	19. $\frac{6}{7} = \frac{36}{?}$
6. $\frac{1}{4} = \frac{9}{12}$	13. $\frac{?}{?} = \frac{21}{24}$	20. $\frac{5}{7} = \frac{?}{28}$
7. $\frac{3}{?} = \frac{9}{21}$	14. $\frac{1}{5} = \frac{7}{35}$	21. $\frac{3}{?} = \frac{21}{24}$

Be sure that the pupils understand that a ratio can be expressed in fractional form as well as with the colon.

21. *At sight:*

1. $.06 \div 6 = ?$ 6. $.096 \div .008 = ?$ 11. $.039 \div 13 = ?$
2. $.25 \div .05 = ?$ 7. $.0075 \div .025 = ?$ 12. $4.8 \div .03 = ?$
3. $4.5 \div 50 = ?$ 8. $2.8 \div .8 = ?$ 13. $1.08 \div 1.2 = ?$
4. $.27 \div .9 = ?$ 9. $3.28 \div .08 = ?$ 14. $10.11 \div .1011 = ?$
5. $.084 \div .12 = ?$ 10. $33.2 \div .04 = ?$ 15. $240 \div .12 = ?$

22. *At sight.* *What per cent of:*   April 2.

1. 45 is 15?   7. $66\frac{2}{3}$ is $33\frac{1}{3}$?   13. 25 is 30?
2. 15 is 45?   8. $33\frac{1}{3}$ is $66\frac{2}{3}$?   14. 30 is 25?
3. 96 is 8?   9. $12\frac{1}{2}$ is $62\frac{1}{2}$?   15. 32 is 24?
4. 8 is 96?   10. $62\frac{1}{2}$ is $12\frac{1}{2}$?   16. 24 is 32?
5. 84 is 7?   11. $87\frac{1}{2}$ is $12\frac{1}{2}$?   17. 36 is 48?
6. 7 is 84?   12. $12\frac{1}{2}$ is $87\frac{1}{2}$?   18. 48 is 36?

23. *Subtract:*

1. $94821\frac{1}{2}$ 3. $72442\frac{2}{3}$ 5. $85694\frac{3}{7}$ 7. $99621\frac{1}{3}$
   $6795\frac{5}{6}$ $6897\frac{7}{8}$ $6983\frac{7}{9}$ $8896\frac{3}{7}$

2. $46985\frac{5}{6}$ 4. $99215\frac{1}{6}$ 6. $74651\frac{1}{8}$ 8. $93211\frac{1}{5}$
   $1989\frac{3}{9}$ $87964\frac{4}{5}$ $49894\frac{2}{7}$ $88791\frac{1}{3}$

24. *Review Questions on Integers and Decimals.*

1. How do you check addition? Subtraction? Why should one make this a habit?

2. Name the terms in subtraction and designate.

3. In making change the "additive" or Austrian method of subtraction is used. Subtract 74¢ from $1 by the Austrian method.

4. Name the terms in multiplication and designate.

5. The multiplicand and multiplier are the factors of what number?

6. Which number in multiplication must always be abstract?

7. The product is always of the same denomination as the ——.

8. In what way are 4 × 6 and 6 × 4 alike? In what way are they different?

9. Explain two ways to check the product in multiplication.

10. Why are successive partial products written one place to the left of the partial product above?

11. Could you obtain the correct answer in multiplication by beginning to multiply with the left-hand figure of the multiplier? Illustrate.

12. When the multiplier or the multiplicand is divided, the product is —— by the same number.

13. Give a rule for pointing off the decimal places in a product.

14. To multiply by .5 is the same as dividing by what integer? By .25?

15. Name the terms in division and designate.

16. Which two of the numbers in division are factors of a third number?

17. When is the quotient a concrete number? When is it abstract?

18. Explain two ways for checking division.

19. Why is the order of the right-hand figure in each partial product the same as that of the quotient?

20. Give a rule for the placing of the decimal point in the quotient.

21. Why is it not customary in ordinary business calculations to carry the quotient farther than three decimal places?

22. The quotient is not affected when the dividend and divisor are both multiplied or divided by the ————.

23. Give the prime factors of all the composite numbers between 70 and 80.

24. What is a common factor or divisor? Illustrate.

25. What is the effect of canceling the same factor from both the dividend and the divisor? Prove.

26. All even numbers are divisible by ——.

27. What numbers are divisible by 5? By 25?

28. Any number ending in —— ciphers is divisible by 4.

29. Any number ending in —— ciphers is divisible by 8.

25. *Solve by short method:*

1. 180 is 15% of what number?
2. 204 is 17% of what number?
3. 744 is 24% of what number?
4. 960 is 16% of what number?
5. 896 is 28% of what number?
6. 988 is 13% of what number?
7. 992 is 32% of what number?
8. 460 is 92% of what number?
9. 228 is 76% of what number?
10. 335 is 67% of what number?

26. *Find the cost at sight:*

Selling Price	Gain	Loss
1. $240	*a.* 33⅓%	*b.* 33⅓%
2. $550	*a.* 37½%	*b.* 37½%
3. $600	*a.* 25%	*b.* 25%
4. $630	*a.* 12½%	*b.* 12½%
5. $700	*a.* 16⅔%	*b.* 16⅔%
6. $210	*a.* 40%	*b.* 40%

27. *City Milk Business — Oral.*

1. A pint of milk weighs approximately 1 pound. **All** but 12½% of this is water. What is the weight of the **water** to be found in one pint of milk?

2. A farmer sold 40 lb. of cream which tested 32% butter fat. For how many pounds of butter fat was he paid?

3. A dairyman has 25 cows in his herd. Ten yield **40** pounds of milk each, daily; ten yield 30 pounds; and 5 yield 20 pounds. The milk averages 4% butter fat. What **is** the total quantity of butter fat produced daily?

4. Skimmed milk is figured at 85% of whole milk. When valued at 20¢ per hundredweight, what is the value of the skim milk from 1000 pounds of whole milk?

5. A driver has delivered milk to 150 customers. These are 60% of all on his route. How many customers has he still to serve?

6. The Renard Milk Company had two bottle fillers which averaged 600 dozen bottles an hour. At this rate, how long does it take to fill one bottle?

7. A driver starts on his route at 5:45 A.M. and returns at 11:00 A.M. How long has he been on the road?

8. Cow A produced for her owner above all expenses $77 annually. Cow B lacked $7.70 of paying the actual expenses of her keep. A herd of eighty cows like A would bring a clear profit of $—— a year, while eighty cows like B would lose the owner annually $——.

9. The wholesale market price on December 11 for second grade creamery butter was 50¢ a pound. This was 83⅓% of the price of fancy creamery. What was the price of the fancy creamery?

10. There were 20 pounds of water in a cask of butter marked 90 pounds. Imagine yourself a pure food inspector and mark the cask. The law states that butter containing over 16% water is adulterated.

28.* *The Circle — Circumference and Area.*

1. The diameter of the outer circle traced by the phonographic needle on a certain record is 9½ inches. The circumference of any circle is 3.1416 (about 3⅐ as you have learned) times the length of the diameter. What was the entire distance traced by the needle in its first circuit? Did the needle trace a perfect circle?

2. The diameter of the last or inner circle traced by the needle was 5 inches. What was the length of the last circuit?

3.† A 10-inch record will require a square envelope of what dimensions? Will the record entirely fill the envelope? Approximately what portion of it does it fill? Allow ¼ inch around the edge.

> To find the circumference of a circle multiply the diameter by 3.1416 (represented by the Greek letter π called *pī*).
>
> To find the area of a circle multiply the area of a square having a like diameter by .7854.

4. The diameter of the earth is approximately 8000 miles. What is the circumference at the equator?

5. How many square inches of tin will be required for the top and the bottom of a vegetable can 4 inches in diameter?

6. The minute hand on a clock is 9 inches long and the hour hand 7 inches long. How much greater is the distance traveled by the minute hand in one circuit than that traveled by the hour hand in one circuit?

† See Table of Contents.

The area of a circle may be considered as made up of an indefinite number of triangles, the sum of whose curved faces is the circumference and whose altitude is the radius of the circle.

Cut out a circle and divide it into sixteen equal parts as shown in the picture. Arrange eight of the parts so that their bases form a (nearly) straight line; invert the other eight and fit them into the triangular spaces thus formed. The resulting figure will be (almost) a parallelogram. How does its base compare with the circumference of the circle? Its height with the radius of the circle?
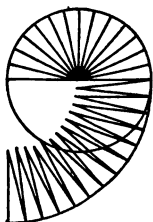
To find the area of a circle (second method) take one half the product of its circumference and its radius.

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7. A circular fountain is 18 feet in diameter. What will it cost to cement the bottom at $2.16 per square yard?

8. A birthday cake 10 inches in diameter is to have placed near its circumference 15 birthday candles. How far apart (approximately) should they be placed?

9. A merry-go-round has an inner row of seats 8 feet from the center and an outer row 12 feet from the center. How much farther does a boy in the outer row ride than one in the inner row if the merry-go-round turns 20 times?

29. *Find the quotient:*

1. 17,155.73 ÷ 3.56
2. 10,677.23 ÷ 15.7
3. 1,962.967 ÷ .479
4. 19,204.098 ÷ 19.6
5. 151,349.3 ÷ 1.89
6. 27,721.97 ÷ 3.96

30.* *Buying Water by Meter.*
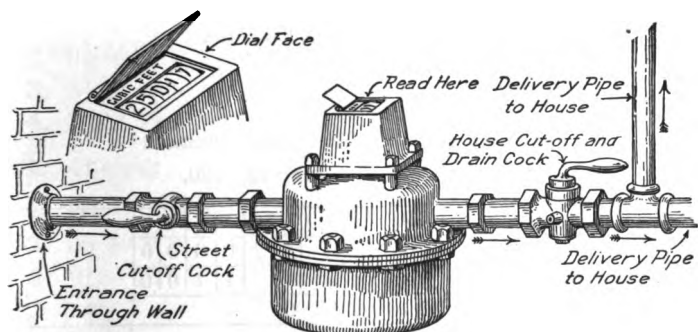
Questions for Investigation.

1. Is the water company in your town owned by the city or by private individuals?

2. How does the water company learn how much water you have used each month?

3. How are the rates fixed by which water is sold in your city?

4. Why does the water company usually prefer to sell water by meter?   In what other way is water sold?

5. What is meant by the "minimum rate" allowed?

6. If you are interested, ask a mechanic to explain how a meter registers that one cubic foot of water has passed through it.

7. Explain how the face of the dial constantly records the amount of water used.

8. One gallon of water contains 231 cubic inches.   How many gallons in 1000 cubic feet of water?

9. At 22 cents per 1000 cubic feet, what is paid by a consumer who uses 5000 gallons of water?

10.

BROWNSBURG WATER COMPANY
113 Monument Place

Water Bill

For Water Service by Meter Measurement

Payable on or before May 10, 1920.

Meter Reading April 17, 1920					2	1	1	0	0
Meter Reading Mar. 17, 1920					2	0	0	0	0
Cubic Feet Used					1	1	0	0

8250 Gallons @ 18¢ per 1000	$?

NOTICE — Presenting this bill at time of payment will save delay.
Receipts will be returned when bill accompanies remittance.
Schedule of water rates, rules and regulations may be had on
application.

What was the amount of the water bill above at 18¢ per
1000 gallons? $7\frac{1}{2}$ gal. = 1 cu. ft.

11. Which is cheaper, to pay $5.50 quarterly as a flat
rate or at the rate of 16¢ per 1000 gallons for an average of
12,500 gallons of water each month for a year?

31. *Written Dictation.*

1. What number increased by $87\frac{1}{2}\%$ of itself equals 45?

2. *a.* $83\frac{1}{3}\%$ of 24 = ?
   b. 24 is $66\frac{2}{3}\%$ of ?

3. A boy spent $\frac{5}{8}$ of his money and had $12 left.   How
much did he spend?

4. How many bushels of potatoes can be bought for
$40 if 5 bushels can be bought for $10?

5. 24 is what per cent of 40?

32. *Find the value of:*

1. $(\frac{2}{3} \times 2\frac{5}{6}) \div (2\frac{1}{3} + 1\frac{5}{6}) = ?$
2. $9\frac{1}{3} \div 3\frac{1}{2} + 2\frac{1}{6} - 5\frac{1}{2} \times \frac{1}{3} = ?$
3. $5\frac{1}{4} \times 1\frac{3}{7} - 1\frac{2}{5} \times 3\frac{3}{4} + 7\frac{1}{3} = ?$
4. $3\frac{3}{4} \times 4\frac{2}{3} - 7\frac{1}{5} \div 1\frac{1}{3} = ?$

33. *At sight:*

1. $83 - 57 = ?$
2. $56 + 29 = ?$
3. $91 - 56 = ?$
4. $95 + 28 = ?$
5. $78 - 29 = ?$
6. $87 + 39 = ?$
7. $78 + 27 = ?$
8. $62 - 38 = ?$
9. $29 + 58 = ?$

34. *Complete:*

1. $\frac{6}{8} = \frac{?}{56}$
2. $\frac{9}{?} = \frac{27}{33}$
3. $\frac{13}{?} = \frac{26}{34}$
4. $\frac{2}{9} = \frac{16}{?}$
5. $\frac{?}{12} = \frac{35}{60}$
6. $\frac{8}{?} = \frac{48}{72}$
7. $\frac{?}{9} = \frac{21}{63}$
8. $\frac{5}{9} = \frac{?}{45}$
9. $\frac{6}{?} = \frac{42}{49}$
10. $1\frac{4}{15} = \frac{28}{?}$
11. $1\frac{2}{15} = \frac{36}{?}$
12. $\frac{3}{4} = \frac{?}{64}$
13. $\frac{6}{?} = \frac{18}{39}$
14. $1\frac{0}{11} = \frac{?}{132}$
15. $\frac{?}{8} = \frac{42}{48}$

35. *What number decreased by:* (At sight)

1. $16\frac{2}{3}\%$ of itself = 25?
2. $87\frac{1}{2}\%$ of itself = 9?
3. $62\frac{1}{2}\%$ of itself = 21?
4. $8\frac{1}{3}\%$ of itself = 66?
5. $83\frac{1}{3}\%$ of itself = 12?
6. $33\frac{1}{3}\%$ of itself = 24?
7. $6\frac{1}{4}\%$ of itself = 45?
8. $12\frac{1}{2}\%$ of itself = 49?
9. 25% of itself = 15?
10. $37\frac{1}{2}\%$ of itself = 45?

36. *Find the interest on:*

1. $360, at $3\frac{1}{2}\%$, from May 5, 1919, to February 8, 1920.

2. $540, at $5\frac{1}{2}\%$, from March 18, 1917, to May 5, 1919.

3. $780, at 6%, from February 10, 1917, to October 4, 1919.

4. $1250, at $4\frac{1}{2}\%$, from January 16, 1919, to December 6, 1920.

5. $5200, at 7%, from April 10, 1917, to January 19, 1919.

6. $650, at $5\frac{1}{2}\%$, from December 23, 1918, to February 4, 1919.

37. *Written Problems.* Solve as many problems as possible by proportion.

1. Mr. Mendel bought land at $85 per acre and sold it again at $102 an acre, thereby gaining $629. How many acres did he sell? What was the per cent of gain?

2. Alfred Clarke agrees to dig a cellar 30 feet long, 24 feet wide, and 6 feet deep. What per cent of the work has he done when he has removed 60 cubic yards of dirt?

3. Two trains are 105 miles apart and are running toward each other, one at the rate of $50\frac{3}{4}$ miles an hour and the other at the rate of $20\frac{4}{5}$ miles an hour. How far apart will they be in half an hour?

4. Philip S. Morgan, who has failed in business, finds his resources to be $20,475, while his liabilities are $37,500. What per cent of his indebtedness can he pay? What will a man lose to whom he owes $2100?

5. If 160 tons of coal can be hauled in 60 loads, how many tons can be hauled in 21 loads?

6. An auctioneer's commissions for a year, at $2\frac{1}{2}\%$, amounted to $3127.50. He was employed 278 days. What was the daily average of his sales?

7. If $1200 yields $280 interest in a certain time, how much does $1500 yield in the same time at the same rate?

8. W. H. Brydon bought a shipment of bricks for $44 @ $16 per M. How many bricks did he buy?

9. If 50 pounds of skimmed milk make 9 pounds of cottage cheese, how much skimmed milk is needed to make $2\frac{1}{4}$ pounds of cottage cheese?

10. Kiser and Company bought 19 pieces of cloth containing $36\frac{1}{2}$ yards each, for which they paid $1.48 per yard. What was the total cost?

11. Charles Malone received $460 for purchasing 1600 barrels of flour on a commission of $2\frac{1}{2}\%$. How much was paid per barrel for the flour?

12. George Burton bought 100 barrels of potatoes at $5 a barrel. He lost 10% of them by freezing and decay. At what price per barrel must he sell the remainder to gain 20% on the investment?

13. If 20 sheep require $4\frac{4}{5}$ acres of land for their support, how many sheep will 72 acres support?

14. What will it cost to fill in a street 840 feet long, 36 feet wide and $5\frac{1}{2}$ feet below grade at $1.50 a cubic yard?

15. B. F. Vary sold a town lot for $1280, which was $\frac{4}{5}$ of its cost. What per cent would he have lost if he had sold the lot for $980?

16. If 16 tons of straw cost $74, how much will 60 tons cost?

17. The distance from Millersville to Clarksburg is $82\frac{1}{2}$ miles. At what rate does a train run per hour to cover the distance in 2 hours 45 minutes?

18. Mr. L. M. Lewis sold broadcloth for $210, thereby losing $12\frac{1}{2}\%$ of the cost. For what should he have sold it to have gained 15% of the cost?

19. Sold tea for 110% of its cost and made a profit of 9¢ on the pound. Find the selling price.

20. When 19 gallons of alcohol cost $152, what will 114 gallons cost? Ratio.

21. How many yards of material 30 inches wide will be needed for a half dozen aprons, each 29 inches long, allowing $4\frac{1}{2}$ inches for a hem and $2\frac{1}{2}$ inches for the waist-band and finishing? How much will the material cost at 35¢ a yard?

22. A man bought a 90-acre farm for $6000 and sold 15 acres of it at cost. How much did he receive for the part sold?

23. A room is 12 feet wide and 15 feet long. A rug on the floor is 2 yards wide and 3 yards long. What per cent of the floor is not covered by the rug?

38.† *On a Dakota Ranch — Contents of a Cylinder.*
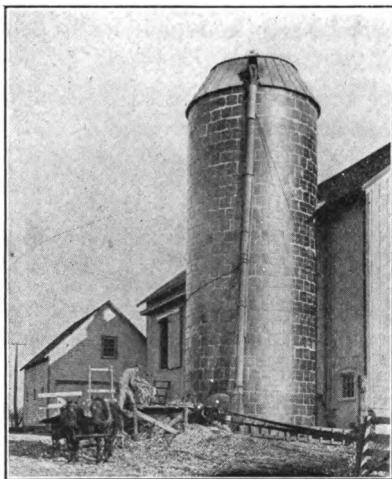
1. *For study.* Mr. **W. H. Pearcy**, who owned a cattle ranch in North Dakota, decided to build a silo 20 feet in diameter and 35 feet in height. How many tons of silage will it hold at an average of 50 cubic feet to the ton?

Solution

20 × 20 × 0.7854 × 1 cu. ft. = 314 cu. ft. (approximate).

35 × 314 cu. ft. = 11,000 cu. ft.

11,000 cu. ft. ÷ 50 cu. ft. = 220 times.

The silo will contain 220 tons of silage.

What is 314 cu. ft.? See rule below. Explain the remainder of the solution.

To obtain the contents of a cylinder:

a. Obtain the contents of a layer 1 foot high by multiplying 1 cubic foot by the area of the base.

b. Obtain the entire contents of the cylinder by multiplying the contents of a layer 1 foot high by the total number of such layers.

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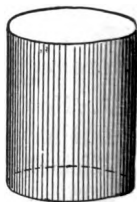
2. Later on Mr. Pearcy built a second silo which was 14 feet in diameter and 25 feet in height. How many tons of silage would it contain?

3. When milk is worth 40¢ a gallon, what does it cost Mr. Pearcy to make a calf that weighs 70 pounds weigh 140 pounds, if $1\frac{1}{4}$ gallons of fresh milk will produce 1 pound of gain, live weight?

4. A calf should gain 2 pounds a day. At this rate what is the cost per day of fattening a calf?

5. When corn was selling at $1.80 a bushel, Mr. Pearcy decided to feed the corn to cattle. He estimated that the increase in the value of the cattle from the corn alone was $2.40 on each bushel used for feed. What was the per cent of increase in the value of corn used as feed?

6. Mr. Pearcy paid $160 for a steer weighing 1000 lb. He sold the steer for $250 when it weighed 1400 lb. What was his profit if it cost $18 per 100 lb. to fatten the steer?

7. If 40 pounds of silage are allowed daily for each steer, how many days will the silage in Mr. Pearcy's large silo last 40 steers?

8. The average weight of a steer one year old is 883 pounds. The average weight of a steer 3 years old is 1226 pounds. The gain in weight has cost $6 per hundred pounds. What has been the cost of the whole gain?

9. One spring Mr. Pearcy shipped two carloads of steers weighing on an average 1400 pounds. If there were 20 steers in each car, what was the cost of transportation at 25¢ per cwt.?

10. One carload of steers brought a profit of $1108.80 and the other a profit of $1267.20. What was the per cent of gain if the cost was $7920?

39. *Complete:*

1. $\frac{5}{9} = \frac{?}{45}$ **6.** $\frac{5}{8} = \frac{?}{48}$ **11.** $\frac{7}{12} = \frac{35}{?}$

2. $\frac{6}{7} = \frac{18}{?}$ **7.** $\frac{11}{12} = \frac{33}{?}$ **12.** $\frac{11}{13} = \frac{?}{78}$

3. $\frac{9}{11} = \frac{54}{?}$ **8.** $\frac{9}{16} = \frac{27}{?}$ **13.** $\frac{8}{15} = \frac{48}{?}$

4. $\frac{7}{10} = \frac{42}{?}$ **9.** $\frac{15}{17} = \frac{?}{34}$ **14.** $\frac{11}{18} = \frac{?}{90}$

5. $\frac{8}{9} = \frac{72}{?}$ **10.** $\frac{9}{14} = \frac{?}{42}$ **15.** $\frac{13}{16} = \frac{65}{?}$

40.* *Proportion — continued.*

See previous lesson, pp. 135, 136.

"The Rule of Three (proportion) is the chiefest and most profitable and the most excellent rule of all arithmetike for which cause it is said philosophers did name it the golden rule." — Humpfrey Baker, 1562 A.D.

1. *For study.*
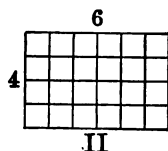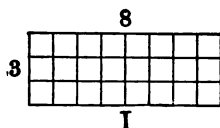
a. The rectangles I and II each contain 24 equal squares and are therefore equal in area.

b. Three proportions may be written showing the ratios of their several dimensions:

$$3:4 = 6:8 \qquad \text{(ratio } \tfrac{3}{4})$$
$$3:6 = 4:8 \qquad \text{(ratio } \tfrac{1}{2})$$
$$4:3 = 8:6 \qquad \text{(ratio } 1\tfrac{1}{3})$$

It will be seen that if the height (or breadth) of one rectangle is the first term of the proportion, its breadth (height) will be the last term. They are the extremes, while the height and breadth of the other rectangle are the means. It will be further seen that the area 24 is found twice in each proportion: $3 \times 8 = 4 \times 6$.

2. Draw two rectangles 3×4 and 2×6. Write the three possible proportions to be found in the ratios of their several dimensions.

3. Prove by drawing rectangles that $\frac{3}{5} = \frac{6}{10}$. In this proportion, which numbers are the means and which the extremes?

4. Multiply the means together and prove that their product equals that of the extremes:

a. $2 : 5 = 4 : 10$ c. $4 : 5 = 16 : 20$ e. $8 : 11 = 16 : 22$

b. $\frac{3}{7} = \frac{9}{21}$ d. $\frac{7}{9} = \frac{21}{27}$ f. $\frac{5}{6} = \frac{20}{24}$

5. *For study.* Find the missing term:

a. $4 : 7 = 8 : ?$
$7 \times 8 \div 4 = 14$
The missing term is 14.

b. $5 : ? = 15 : 27$
$5 \times 27 \div 15 = 9$
The missing term is 9.

c. $5 : 8 = 15 : ?$ e. $6 : 7 = ? : 21$ g. $? : 9 = 28 : 36$

d. $\frac{7}{5} = \frac{24}{30}$ f. $\frac{3}{4} = \frac{?}{20}$ h. $\frac{8}{?} = \frac{32}{36}$

41. *At sight:*

1. $25 \times 88 = ?$ 5. $33\frac{1}{3} \times 75 = ?$ 9. $37\frac{1}{2} \times 64 = ?$
2. $75 \times 96 = ?$ 6. $16\frac{2}{3} \times 96 = ?$ 10. $62\frac{1}{2} \times 96 = ?$
3. $33\frac{1}{3} \times 48 = ?$ 7. $6\frac{1}{4} \times 32 = ?$ 11. $66\frac{2}{3} \times 24 = ?$
4. $12\frac{1}{2} \times 136 = ?$ 8. $8\frac{1}{3} \times 84 = ?$ 12. $14\frac{2}{7} \times 49 = ?$

42. *Add, grouping for 10's:*

1.	2.	3.	4.
42,653	27,435	16,736	75,836
81,515	41,203	40,275	40,187
27,294	34,546	31,014	38,265
16,248	28,711	27,901	25,726
11,612	34,552	63,283	53,105
73,253	73,216	15,436	44,682
46,210	30,481	51,602	37,426
43,824	17,104	36,584	21,109
25,276	81,023	44,351	63,584
62,504	53,665	12,348	92,435

39
35
40
36
39
430,389

It is well to form the habit of using the computer's method of keeping the sum of each column separate until the end and then getting the sum of all. See example 1 above.

43. *Review Questions on Common Fractions.*

1. Prove by drawing that $\frac{3}{4}$ of 1 equals $\frac{1}{4}$ of 3.

2. Write the fraction $\frac{3}{4}$ with the ratio sign.

3. The horizontal line found between the numerator and the denominator indicates which of the fundamental processes?

4. Illustrate two ways of multiplying a common fraction.

5. Illustrate two ways of dividing a common fraction.

6. Of two fractions having the same denominator, the one having the greater numerator expresses the —— value.

7. Of two fractions having the same numerator, the one having the —— denominator expresses the greater value.

8. What is the effect upon the value of a fraction when both the numerator and the denominator of the fraction are multiplied by the same number? Explain.

9. What is said of a fraction when its numerator and its denominator are not prime to each other? How can they be made so?

10. What is the meaning of the word "reduction"?

11. Why is it necessary to reduce fractions to the same denomination before adding or subtracting them?

12. Give a rule for finding the least common multiple.

13. In multiplying by a fraction, how does the product compare with the value of the multiplicand? Why?

14. To multiply by a fraction whose numerator is 1 gives the same result as dividing by what integer? Why?

15. What is the reciprocal of a fraction?

16. In dividing by a fraction, how does the value of the quotient compare with the value of the dividend? Why?

17. To divide by a fraction whose numerator is 1 will give the same result as multiplying by what integer? Why?

18. Why should cancellation be employed whenever possible?

19. How does a decimal fraction get its name?

20. What is the economy in writing a fraction with the decimal point rather than with the denominator?

21. What is the effect upon the value of a proper fraction of adding the same number to both the numerator and the denominator? Of an improper fraction?

44.* *To find the Least Common Multiple.*

1. *For study.* Find the least common multiple of: 36, 48, 72.

Old Method	New Method
a. $36 = 2 \times 3^2$	*b.* $2)36 - 48 - 72$
$48 = 2^4 \times 3$	$2)18 - 24 - 36$
$72 = 2^3 \times 3^2$	$2) \ 9 - 12 - 18$
	$3) \ 9 - 6 \ - 9$
	$3) \ 3 - 2 \ - 3$
	$1 - 2 \ - 1$
L. C. M. $= 2^4 \times 3^2 = 144.$	L. C. M. $= 144.$

The small figure found to the right of certain of the factors above is called an *exponent*. It indicates the number of times that factor is found in the number. For example, $8 = 2^3$ or $2 \times 2 \times 2$.

2. Find the L. C. M. of: 12, 24, 63, 84; of 33, 42, 66, 70, 84.

45. *Find the difference between:*

1. Nine thousand five hundred sixty-nine and ninety-six ten-thousandths; and seventy-eight thousand four hundred ninety-six and ninety-six thousandths.

2. Six thousand nine hundred twenty-eight and six hundred eighty-two ten-thousandths; and nine thousand seven hundred twenty-four and twenty-four thousandths.

3. Seven thousand eight hundred sixty-four and eight hundred ninety-eight thousandths; and ninety-four thousand and ninety-four thousandths.

46.* *The Rule of Three Applied to Percentage.*

Case I. *For study.* Mr. F. H. Feltman, a shoe dealer, pays $5600 for his fall stock of shoes. For what must he sell them to have a profit of 25% on the cost?

Solution $100\% : 125\% = \$5600 : ?$

$$\frac{125 \times \$5600}{100} \text{ or } 1.25 \times \$5600 = \$7000.$$

The shoes must be sold for $7000.

Case II. *For study.* Mr. F. H. Feltman made a profit of $1400 on his fall stock of shoes. This was 25% of the cost. What was the cost?

Solution $25\% : 100\% = \$1400 : ?$

$$\frac{\overset{4}{\cancel{100}} \times \$1400}{\underset{1}{\cancel{25}}} = \$5600.$$

The shoes cost him $5600.

Case III. *For study.* Mr. Feltman made a profit of $1400 on his fall stock of shoes which had cost him $5600. What was his rate per cent of gain?

Solution $\$1400 : \$5600 = ? : 100\%$

$$\frac{\overset{25}{\cancel{100}} \times \overset{1}{\cancel{\$1400}}}{\underset{4}{\cancel{\$5600}}} = 25 \text{ times.}$$

His rate of gain was 25%.

1. Albert McQueen cleared $30 upon soap that had cost him $125. What was his per cent of gain?

2. The Stewart Milk Company sold five milk wagons that had originally cost them $2000 at a loss of 45%. What was the selling price?

3. F. C. Melcher sold a book for $4.80 that had cost $3.60. What was his per cent of gain?

4. An automobile is sold by a factory for $1022, a gain of 40% over the cost of production. How much did it cost to manufacture the car?

5. Mr. R. H. Spencer sold a city lot for $1200, for which he had paid $1500. What per cent did he lose?

47. *Oral Problems.*

1. If I can buy a pigeon for 37½¢, how many can I buy for $1.50?

2. 12½ is what part of 50? 12½ is what per cent of 50? 12½ is what decimal of 50? 50 is what per cent of 12½?

3. A dealer in agricultural implements sells for $20 a plow which cost $18. What per cent does he gain?

4. At the rate of 3 spools of basting thread for 8¢, how many dozen can be bought for $0.96?

5. The wind blew down 8⅓% of the trees in an orchard and left 33 trees standing. How many trees were in the orchard at first?

6. 9 hours are what per cent of a day?

7. 50 seconds are what per cent of a minute?

8. At $3 a day, how much is due a man for 2¾ days' work?

9. At 16⅔¢ a dozen, how many dozen can be bought for $5?

10. A woman who raises chickens put 15 eggs under each of six hens. If 83⅓% of the eggs hatched, how many chickens were hatched?

11. If 8 oranges cost 30¢, what will 2⅔ dozen cost?

12. In a certain school the morning recess is 15 minutes and the afternoon recess ⅔ as long. In two weeks, how much time is spent in recess?

13. Twenty-five dollars' worth of coal lasts a family 15 weeks; how much will it take for 25 weeks?

14. What is the interest on $300 for 2 years at 5%?

15. Two men travel in opposite directions. One goes at the rate of 3½ miles an hour and the other at the rate of 4½ miles an hour. How far apart are they at the end of 3 hours?

16. If the rate of taxation is $1.75 on $100, what is the tax on property assessed at $10,000?

48.† *The Buying and Selling of Meat — Wholesale.*
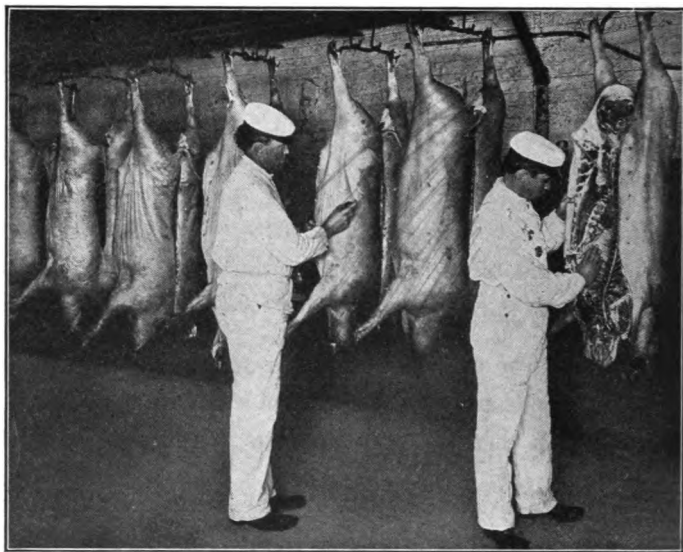
1. The average American eats 172 pounds of meat annually, while the rest of mankind eats only 43 pounds. What is the ratio expressed in per cent of 172 to 43?

2. The meat packing industry in the United States in a certain year was valued at 1 billion 370 million dollars. A half dozen packing houses did 75% of this business. Do you see any advantage or disadvantage in having this industry handled by a few firms?

3. The Union Stock Yards of Chicago receive an average of about 7000 cattle, 17,000 sheep and 24,100 hogs every working day. The receipts for cattle in a certain year were $2,601,000; for sheep $5,378,000; and for hogs $6,618,000. What was the average price of one animal of each kind?

4. In the year mentioned above, due to an epidemic, .79% of the cattle were condemned. At this rate, what was the value of the beef condemned?

5. Why is the same rate of commission charged for selling animals of poor quality as for those of good quality? If any difference were made, what should it be? Is there a difference in the amount of commission?

6. Two beeves weighing 1200 pounds each were sold. The dressed weight of one was 67% of its live weight and of the other 51% of its live weight. If both had been sold at 34¢ per pound, dressed weight, how many more dollars would the better animal have brought?

7. A 1500 lb. steer was sold at 16¢ per pound live weight. When slaughtered, the carcass yielded 64% of the live weight. Had it been sold on a basis of dressed weight, what price per pound would have been required to have made the same selling price?

8. In sugar-curing hams, 8 pounds of salt, 2 pounds of brown sugar and 2 ounces of salt-peter are used to each 100 pounds of meat. How much of each ingredient does this allow to one pound of meat? Express decimally.

9. We export annually 500 million pounds of lard, which is 50% of the amount kept in this country. What is the weight of the total output?

49. *Complete the proportion:*

1. $1:2 = 1\frac{1}{2}:?$	**11.** $1:3 = 1\frac{1}{3}:?$
2. $1:4 = 1\frac{1}{4}:?$	**12.** $1:3 = 2\frac{1}{2}:?$
3. $1:5 = 1\frac{1}{5}:?$	**13.** $3:4 = 7\frac{1}{2}:?$
4. $1:3 = 2\frac{2}{3}:?$	**14.** $1:3 = 1\frac{1}{2}:?$
5. $2:3 = 6\frac{2}{3}:?$	**15.** $3:4 = 4\frac{1}{2}:?$
6. $2:3 = 3\frac{1}{3}:?$	**16.** $9:8 = 4\frac{1}{2}:?$
7. $3:2 = 4\frac{1}{2}:?$	**17.** $3:4 = 5\frac{1}{4}:?$
8. $5:8 = 7\frac{1}{2}:?$	**18.** $4:3 = 9\frac{1}{3}:?$
9. $8:5 = 4\frac{4}{5}:?$	**19.** $5:6 = 3\frac{1}{3}:?$
10. $8:9 = 5\frac{1}{3}:?$	**20.** $6:5 = 7\frac{1}{5}:?$

50.* *Complex Fractions.*

1. *For study.*

$$\frac{\frac{2}{3}}{\frac{3}{4}} = \frac{2}{3} \div \frac{3}{4}$$

$$\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$$

2. *For study.*

$$\frac{\frac{2}{3}}{\frac{5}{6}} = \frac{2}{3} \div \frac{5}{6}$$

$$\frac{2}{3} \div \frac{5}{6} = \frac{2}{\overset{1}{\underset{1}{3}}} \times \frac{\overset{2}{6}}{5} = \frac{4}{5}$$

Simplify and solve:

3. $\dfrac{\frac{7}{8}}{\frac{3}{5}}$ **4.** $\dfrac{\frac{7}{9}}{\frac{3}{4}}$ **5.** $\dfrac{\frac{1}{2} + \frac{1}{3}}{\frac{3}{4}}$ **6.** $\dfrac{\frac{4}{5} - \frac{1}{2}}{\frac{2}{3}}$

7. When $16\frac{1}{2}$ yards of silk sold for $\$29\frac{7}{10}$, what was the selling price per yard?

8. A wheel travels 377.3 feet during $24\frac{1}{2}$ revolutions. How many feet does it travel in one revolution?

9. How many tons of hay at $\$18\frac{1}{2}$ a ton can be bought for $\$70\frac{3}{10}$?

51. *Written Dictation.*

1. Complete the proportion: $6 : 7 = 18 : ?$

2. $25 \times 24 = ?$

3. Find the interest on $200 at 5% for 1 year 6 months.

4. At $2\frac{1}{2}\%$, what is the commission on sales amounting to $300?

5. Howard spent $0.25 for a ball. How much money had he if this was 5% of all he had?

52. *Multiply:*

1. $\begin{array}{r} 27,988 \\ 297\frac{3}{4} \\ \hline \end{array}$ **3.** $\begin{array}{r} 87,960 \\ 864\frac{5}{8} \\ \hline \end{array}$ **5.** $\begin{array}{r} 48,622 \\ 249\frac{6}{7} \\ \hline \end{array}$ **7.** $\begin{array}{r} 39,675 \\ 726\frac{3}{8} \\ \hline \end{array}$

2. $\begin{array}{r} 96,426 \\ 479\frac{5}{6} \\ \hline \end{array}$ **4.** $\begin{array}{r} 37,863 \\ 867\frac{5}{9} \\ \hline \end{array}$ **6.** $\begin{array}{r} 73,566 \\ 239\frac{2}{3} \\ \hline \end{array}$ **8.** $\begin{array}{r} 87,968 \\ 368\frac{7}{8} \\ \hline \end{array}$

53. *Written Problems.* Solve as many problems as possible by proportion.

1. How many gallons of water are there in a standpipe 10 ft. in diameter and 40 ft. high? (1 cu. ft. = $7\frac{1}{2}$ gal.)

2. Mr. Robson loaned $300 due in 1 yr. 4 mo. at 6%. If he discounted the note 6 months after date at 6%, how much did he receive for it?

3. Harry wishes to plaster the walls and ceiling of two rooms. The first room is 9 × 12 feet and the second is 15 × 18 ft. The height of each room is 9 feet. What will be the cost of plastering the two rooms at 50¢ a square yard? Solve by the shortest method.

4. If it costs 4\frac{1}{2}$ to ship 30 cans of milk, how many can be shipped the same distance for $6?

5. The first sewing machine was patented by Elias Howe on September 10, 1846. The second patent for a sewing machine was taken out by Allan B. Wilson on November 12, 1850. How much time had elapsed between the inventions?

6. A man bought a tract of forest land containing 240 acres. The first year he cleared 25% of it. $16\frac{2}{3}$% of this cleared portion was set in peach trees. How many acres were in the peach orchard? How many acres were still in woodland?

7. Which is cheaper, a 14-oz. loaf at 10¢ or a 22-oz. loaf at 15¢?

8. In 1918, the assessed valuation of property in a certain city was $213,705,875. The tax levy for track elevation that year was 6¢ on $100. What was the amount of taxes available for track elevation?

9. Mr. Johnson rented a field in return for $33\frac{1}{3}$% of the grain to be raised. If Mr. Johnson's share was worth $300 for grain at $1.50 a bushel, how many bushels were raised in all?

10. Harold bought a tent from Donald at $83\frac{1}{3}$% of what it had cost Donald. If Donald's loss was $8, how much did Harold pay for it?

11. A farmer raised 28 bushels of wheat to the acre last year. This was $\frac{7}{8}$ of the yield per acre of the year before. If he had 20 acres in wheat each year, what was the total crop for the two years?

12. Find the interest on $3590 at $5\frac{1}{2}\%$ from January 10, 1919, to December 1 of the same year.

13. At $17\frac{1}{2}¢$ each, what would be the cost of a sufficient number of railroad ties for one mile of track, if 6 ties were required for one rod?

14. Charles Brackett worked $3\frac{1}{4}$ days for J. F. Delker at $2.75 per day. Make out and receipt the bill.

15. A stationer bought 2880 lead pencils at $4 per gross. He sold them at $4¢$ each. How much was his per cent of gain?

16. A schoolroom floor is 25 feet by 28 feet. The desks are 8 feet from the front wall and $2\frac{1}{2}$ feet from each of the other three walls. Make a drawing, using $\frac{1}{4}$ of an inch to the foot, showing the schoolroom and the space occupied by the pupils' desks.

17.
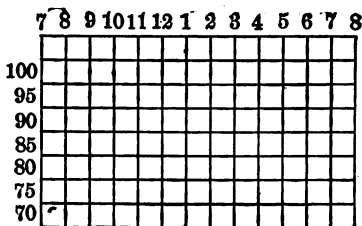
Copy the above and make a graph showing that the temperature on a certain day in August was 79 at 7 A.M., 94 at 2 P.M., and 82 at 7 P.M.

54.* *Combining Operations.*

1. *For study.* I bought 24 acres of land at $60 an acre and sold them at $72 an acre. Required my total gain.

Long Process	Combination Process
24 × $60 = $1440 c.	24 × ($72 − $60) = $288 g.
24 × $72 = $1728 s. p.	
$1728 − $1440 = $288 g.	

My total gain was $288.

2. *For study.* I sold 15 dozen eggs at 40¢ a dozen and received in exchange 30 pounds of granulated sugar. What was the price of the sugar per pound?

Long Process	Combination Process
15 × 40¢ = $6.00	$\dfrac{\overset{20}{\cancel{15} \times \cancel{40¢}}}{\underset{2}{\cancel{30}}} = 20¢$
$6.00 ÷ 30 = $.20	

The sugar cost $.20 per pound.

3. During June a grocer took in on an average $36 on each of 25 days. During July, $48 on each of 25 days. How much more did he take in during July than in June?

4. A quantity of corn consisting of 250 bushels, each bushel weighing 56 pounds, was hauled in 7 loads. What was the average weight of each load?

5. On Monday 1800 people attended the State Fair, and on Tuesday 2250 people attended. The tickets were $.50 each. How much more was taken in on Tuesday?

6. How many years would it require a laborer who saves $18 a month for 12 months in a year to pay for 6 acres of ground at $36 an acre?

7. The yield of wheat from a 5-acre field is estimated at 30 bushels per acre. If a bushel of wheat weighs 60 pounds, how many tons are there in the yield?

55. *Buying and Selling of Meat — Retail.*
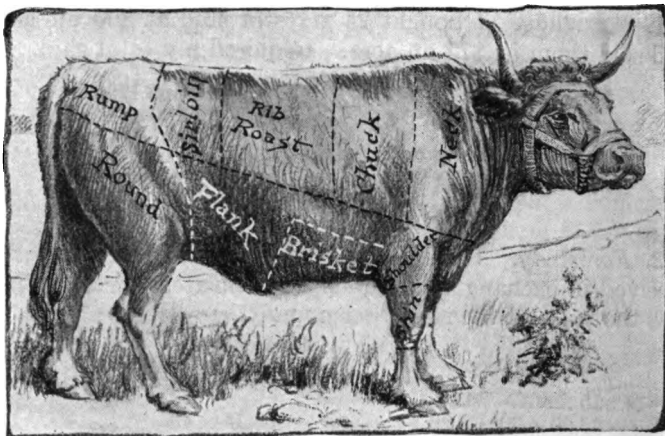
1. A butcher bought a steer weighing 1150 pounds. When killed and dressed, the marketable meat weighed 62% of the live weight. He paid $16 per hundred for the steer. At what average price per pound must he sell the meat to gain 20% on his investment?

2. In a certain steer the round of the beef weighed 64.8 pounds. Of this 26% was fat and bone. What was the weight of the lean?

3.† When loin steak is bought at 42¢ a pound, and only 54% of it is edible, the rest being fat and bone, what is the real price per pound?

4.† Which is the more profitable to buy and how much: plate meat at 30¢ a pound or chuck at 32¢ a pound if 40% of the plate meat and 30% of the chuck is fat and bone?

5. If 120 pounds of loin lose 15% in trimming, how many pounds are actually retailed? If they are sold at 42¢ a pound, how much do they bring?

† See Table of Contents.

56. *Complete the proportion:*

1. $\frac{1}{3} : \frac{2}{3} = 4 : ?$
2. $\frac{3}{4} : \frac{1}{4} = 6 : ?$
3. $\frac{3}{8} : \frac{3}{4} = 6 : ?$
4. $\frac{3}{4} : \frac{3}{8} = 6 : ?$
5. $\frac{7}{10} : \frac{9}{10} = 21 : ?$
6. $1\frac{1}{2} : 3 = 4 : ?$
7. $3 : 1\frac{1}{2} = 5 : ?$
8. $1\frac{1}{3} : 4 = 4 : ?$
9. $7 : 3\frac{1}{2} = 15 : ?$
10. $\frac{2}{3} : 1 = 6 : ?$

57. *Find the cost. At sight.*

Selling Price	Gain		Selling Price	Loss
1. $440	$33\frac{1}{3}\%$		5. $840	$12\frac{1}{2}\%$
2. $1200	20%		6. $350	$16\frac{2}{3}\%$
3. $660	$37\frac{1}{2}\%$		7. $180	$62\frac{1}{2}\%$
4. $360	$66\frac{2}{3}\%$		8. $210	25%

58. *At sight:*

1. *a.* 72 is what per cent of 96?
   b. 96 is what per cent of 72?
2. *a.* 18 is what per cent of 27?
   b. 27 is what per cent of 18?
3. *a.* 8 is what per cent of 64?
   b. 64 is what per cent of 8?
4. *a.* 15 is what per cent of 24?
   b. 24 is what per cent of 15?
5. *a.* 60 is what per cent of 75?
   b. 75 is what per cent of 60?
6. *a.* 56 is what per cent of 64?
   b. 64 is what per cent of 56?

59. *Solve by cancellation:*

1. $\dfrac{4.5 \times 36}{9 \times .5} = ?$
2. $\dfrac{5 \times 1.5}{.25 \times 18} = ?$
3. $\dfrac{4.8 \times 22}{12 \times .2} = ?$
4. $\dfrac{63 \times 5.2}{7 \times 1.3} = ?$
5. $\dfrac{7.2 \times 54}{.09 \times 16} = ?$
6. $\dfrac{3.5 \times 72}{63 \times .04} = ?$

60. *Subtract:*

1. $6847\frac{2}{3}$
   $5979\frac{9}{10}$

2. $5645\frac{1}{5}$
   $3987\frac{4}{7}$

3. $2865\frac{4}{5}$
   $1798\frac{7}{8}$

4. $2465\frac{3}{8}$
   $1899\frac{2}{3}$

5. $9965\frac{4}{7}$
   $8698\frac{8}{9}$

6. $6789\frac{2}{7}$
   $5899\frac{1}{2}$

7. $75579\frac{1}{4}$
   $69795\frac{5}{9}$

8. $45235\frac{5}{7}$
   $29784\frac{7}{8}$

61.* *Compound Interest.*

Savings banks usually pay interest every six months or every three months. When this interest becomes due it is added to the principal and the total amount then draws interest. The investor is then said to receive *Compound Interest* on his money.

In computing compound interest, banks, as a rule, disregard any sum that is less than a dollar. Interest is paid only on such sums as have been on deposit for the entire interest term, the period for which payments are due, as January 1 to July 1, in some banks; in others January 1 to April 1, July 1 to October 1.

⌐ 1. *For study.* Mr. A. C. Hutchins deposited $1000 in a savings bank on July 1, 1918, which paid a semi-annual interest of 4%. What was the amount due him January 1, 1920, at compound interest? What would he have received at simple interest?

<div align="center">Solution</div>

$1000	Principal, July 1, '18
20	Int. 6 mo. at 4 %
$1020	Principal Jan. 1, '19
20.40	Int. on second principal.
$1040.40	Principal July 1, '19
20.80	Int. on third principal (40 cents not used)
$1061.20	Amount due Jan. 1, 1920.
$1060.	Amount at simple interest.
$ 1.20	Excess of compound interest over simple interest.

The compound interest exceeded the simple interest by $1.20.

2. What may one draw at the end of five years if he regularly deposits $500 semi-annually in a savings bank paying 3% compounded semi-annually?

3. Miss Anna Lee deposited $800 in a savings bank on May 1 and withdrew it with interest on February 1 of the following year. The bank paid 4 % interest on deposits July 1 and January 1. What amount did she withdraw?

COMPOUND INTEREST TABLES

(Use for original problems)

TABLE A

Interest compounded every 6 months at the rate of 4 per cent

In 5   years $100 will turn into $121.90
In 6   years $100 will turn into $126.82
In 10   years $100 will turn into $148.59
In 15   years $100 will turn into $181.14
In $17\frac{1}{2}$ years $100 will turn into $200.00 (199.99)

TABLE B

Column *A* shows how much $1 deposited in the bank at the end of each 6 months will amount to at the end of any year or half year at 4 per cent interest, compounded semi-annually.

Column *B* shows how much $2 deposited at the end of each 6 months will amount to at the end of any year, interest at 4 per cent, compounded semi-annually.

At the End of Year	Column A	Column B
$\frac{1}{2}$	$1.000	$2.000
1	2.020	4.040
$1\frac{1}{2}$	3.060	6.120
2	4.122	8.244
$2\frac{1}{2}$	5.204	10.408
3	6.308	12.616
$3\frac{1}{2}$	7.434	14.868
4	8.583	17.166
$4\frac{1}{2}$	9.755	19.510
5	10.950	21.900
$5\frac{1}{2}$	12.169	24.338
6	13.412	26.824
7	15.974	31.948
10	24.297	48.594
15	40.568	81.136
16	44.227	88.454
$16\frac{1}{2}$	46.112	92.224
17	48.034	96.068

62. *At sight:*

  1. (*a*) $5 \div 25$; (*b*) $.5 \div 2.5$; (*c*) $.05 \div .25$; (*d*) $50 \div 250$.

  2. (*a*) $64 \div 16$; (*b*) $64 \div 160$; (*c*) $640 \div 16$; (*d*) $640 \div 160$.

63. *The Government and Compound Interest.*
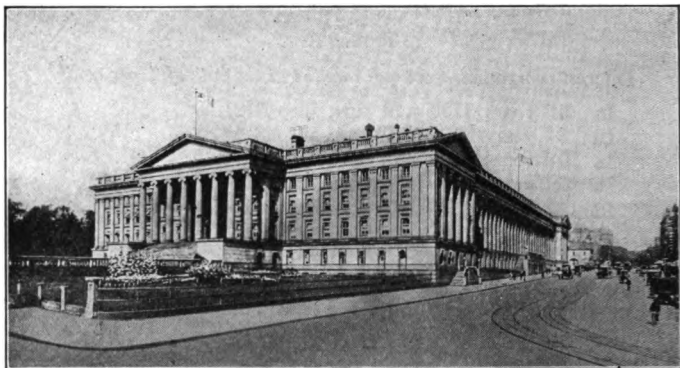
1. In May 1919, the United States Government offered War Savings Stamps at 4% compounded quarterly, to mature in January 1924. How many quarters in that time?

2. A merchant bought a bill of goods for $828. A discount of 5% was given for cash payment. With the discount he bought War Savings Stamps at $4.14. How many?

3. A girl bought a War Savings Stamp each week for one year at the average cost of $4.18. How much did she invest? What is the maturity value of her investment?

4. What is the saving if one buys 20 War Savings Stamps in May, 1919, at $4.16 each and exchanges them in September for a Treasury Savings Certificate at $83.80?

5. It is estimated that our annual waste of food amounts to $700,000,000. How many $1000 Treasury Savings Certificates could be bought with this sum?

6. The Second Liberty Loan bonds pay 4% interest, payable every 6 months. If you held a $100 bond, what is the amount of the semi-annual interest coupon attached to the bond? If you deposited each coupon received at 4% interest, compounded semi-annually for 17 years, what amount might you draw at the expiration of that time?

64. *Selling Railroad Tickets — Dramatize.*

Akron	Ava	Beaver	Dille	Dover	Junction	Key
56¢	24¢	$1.12	85¢	$2.24	15¢	93¢

Kimbolt	Newcomb	Ozark	Orange	Porter	Rayland	York
$1.54	$2.12	62¢	45¢	$1.05	$1.68	$1.79

	Number of Tickets	Desti-nation	Money Presented
1.	2	Dille	$2.00
2.	3	Orange	$1.50
3.	2	Porter	$5.00
4.	1	Beaver	$2.00
5.	3	Dover	$10.00
6.	1	Newcomb	$5.00
7.	2	Kimbolt	$10.00
8.	5	Junction	$2.00
9.	2	Key	$2.00
10.	1	Beaver	$2.00
11.	2	Porter	$5.00
12.	1	York	$2.00
13.	3	Akron	$5.00
14.	2	Ava	$1.00
15.	1	Dover	$5.00
16.	2	Orange	$1.00
17.	4	Junction	$2.00
18.	2	Newcomb	$5.00
19.	3	Ozark	$2.00
20.	1	York	$5.00
21.	1	Rayland	$2.00
22.	3	Dille	$5.00
23.	1	Orange	$1.00
24.	2	York	$5.00
25.	1	Kimbolt	$2.00
26.	3	Newcomb	$10.00

Ticket seller should name coins given in change. Appoint a new ticket seller frequently.

65. *Household Accounts.*

1. Mrs. C. A. Parker, who works in a department store at $25 a week, keeps a weekly account of the expenses of herself and her little daughter. How much money has she on hand, January 12?

		Expense	Dr.		Cr.	
1920						
Jan.	3	On hand	$21	50		
	5	Salary	25	00		
	6	Room rent			$ 3	50
	7	Car fares			1	00
	8	Hat for Alice			1	80
	9	Board			10	00
	10	Sundries			1	35
		Balance				
Jan.	12	On hand				

Do you approve of the judgment Mrs. Parker shows in apportioning her expenditures? Is she living within her means?

2. Make out another weekly account for Mrs. Parker including other necessary expenses she must incur. Remember that she needs some recreation and also her daughter must get an education.

3. Social workers have found that the average family spends about 25% of the annual income for food and a like amount for rent. Make out the yearly budget for a man with a wife and two children whose salary is $2100 a year.

4. If you were a man with a family, saving annually 20% of your salary and within the year the cost of living advanced 40%, where would you "cut expenses" providing you did not receive an advance in salary?

66. *Written Dictation.*

1. $\frac{1}{16}\%$ = what decimal?

2. What number decreased by $62\frac{1}{2}\%$ of itself = 24?

3. What is the per cent of profit on potatoes bought at $1.50 a bushel and retailed at 50¢ a peck?

4. The assessed value of some real estate was $4000; the rate was $2 on $100. What were the taxes?

5. A house bought for $3200 was sold for $3000. What per cent was lost?

67.* *Division by Aliquot Parts:*

1. *For study.*

$250 \div 12\frac{1}{2} = ?$
$12\frac{1}{2} = \frac{100}{8}$
$250 \div \frac{100}{8} = 2.5 \times 8 = 20$

2. *For study.*

$600 \div 66\frac{2}{3} = ?$
$66\frac{2}{3} = \frac{200}{3}$
$600 \div \frac{200}{3} = 3 \times 3 = 9$

3. $600 \div 33\frac{1}{3} = ?$

4. $540 \div 33\frac{1}{3} = ?$

5. $400 \div 87\frac{1}{2} = ?$

6. $5280 \div 37\frac{1}{2} = ?$

7. $840 \div 87\frac{1}{2} = ?$

8. $700 \div 25 = ?$

9. $640 \div 12\frac{1}{2} = ?$

10. $1500 \div 25 = ?$

11. $360 \div 75 = ?$

12. $360 \div 62\frac{1}{2} = ?$

13. $300 \div 16\frac{2}{3} = ?$

14. $120 \div 66\frac{2}{3} = ?$

15. $3200 \div 62\frac{1}{2} = ?$

16. $720 \div 37\frac{1}{2} = ?$

17. $450 \div 83\frac{1}{3} = ?$

68. *Divide:*

1. $835.63 \div .387$

2. $296.4 \div 397$

3. $4551 \div .469$

4. $9836.2 \div 29.6$

5. $859.33 \div 1.98$

6. $4175.9 \div 3.78$

69. *Find the value of:*

1. $\dfrac{7.2 \times 11}{6.6 \times 1.8} = ?$

2. $\dfrac{84 \times 5.2}{13 \times 1.2} = ?$

3. $\dfrac{.12 \times 84}{6 \times 2.1} = ?$

4. $\dfrac{.32 \times 63}{14 \times .08} = ?$

5. $\dfrac{96 \times .9}{1.5 \times 24} = ?$

6. $\dfrac{5.1 \times 96}{17 \times 2.4} = ?$

7. $\dfrac{4.9 \times 18}{1.4 \times 6} = ?$

8. $\dfrac{12.1 \times 81}{1.7 \times 55} = ?$

9. $\dfrac{1.44 \times 32}{1.6 \times 2.4} = ?$

70. *Written Problems.*

1.† I wish to borrow $500 from a bank on a 60-day note. The rate of discount is 6%. The face of my note should be how much in order that I may receive $500?

2. Glass jars filled with marmalade can be bought at 50¢ each or at $5.50 for a dozen jars. How much is saved by buying 36 jars by the dozen rather than by buying single jars?

3. A hurricane produces a pressure of 47$\frac{2}{5}$ pounds against a surface of one square foot. How much is the pressure against the side of a house 40 feet long by 35 feet wide?

4. If $\frac{7}{8}$ of a yard of velvet cost $4.20, how much will 4$\frac{3}{8}$ yards cost?

5. Which is cheaper, to buy for a dress, 8 yards of plain goods 27 inches wide at 75¢ per yard or 4$\frac{1}{2}$ yards of the same quality 54 inches wide at $1.25 per yard?

6. How many cubic feet of air in the room 24$\frac{2}{3}$ feet long, 15 feet wide by 9$\frac{1}{2}$ feet high? Find its weight in pounds, if one cubic foot of air weighs 1.26 ounces.

7. A bar of metal 2$\frac{5}{12}$ ft. long weighs 42$\frac{3}{4}$ pounds. What will a similar bar 4$\frac{5}{8}$ feet long weigh?

8. A housekeeper purchases eggs at the rate of 45¢ per dozen from a neighbor who keeps hens. At the grocery store eggs would have averaged 50 cents a dozen during this time. How much does the housekeeper save in 15 weeks, if she buys 2 dozen a week?

9. At 33$\frac{1}{3}$¢ a pound, how much coffee can I buy for 25¢?

10. An agent sold a piece of property for $3000. He charged 5% for the first thousand and 3% for the rest. How much did he receive?

11. In a very good incubator hatch of 240 eggs, 220 were found to be fertile and of these 210 hatched. Express the results in percentages.

12. How many yards of 3-inch bandages can a surgeon make from 12½ yards of linen one yard wide?

13. The morning session of school begins at 8:30 and closes at noon. The afternoon session is from 1:30 to 3:00. The school day is what per cent of the 8-hour day?

14. A quantity of hops lost 83⅓% of its weight in drying. The dried hops weighed 320 pounds. What had been their weight before drying?

15. If 5% is lost by selling an article for $5.70, what per cent is gained or lost by selling it for $6.30?

16. A father worked 6 days at $2⅝ per day, his son 5 days at $1¾, his daughter 3 days at $⅘. What were their total earnings for the week?

17. After spending 37½% of her money, Mrs. Clarke had enough left to buy 12 yards of crash at 25¢ a yard. How much crash could she have bought with all her money?

18. The Wells family took a trip to Europe. They landed at Liverpool and traveled through England, France, Holland, Switzerland and Italy. Name the pieces of money which they found in common use in each country. Give the value of each in our money.

19. Make an original problem about one interesting day which the Wells family spent while in Europe. Require a knowledge of foreign money in the solution.

20. On arriving in Liverpool Mr. Wells cabled his business partner in New York of their safe arrival. The message was sent at 10:00 A.M. Allowing one hour for delay, at what time did it reach New York? See map on page 77.

21. Make two original problems for the Wells family requiring a knowledge of the metric tables of length and weight.

71. *Find the cost and selling price, short method:*

	Gain	Rate		Loss	Rate		Gain	Rate
1.	$168	14%	**5.**	$175.95	15%	**9.**	$62.58	7%
2.	$2500	8%	**6.**	$977.40	27%	**10.**	$96.47	11%
3.	$256.80	12%	**7.**	$1564	23%	**11.**	$95.38	19%
4.	$162.50	13%	**8.**	$86.40	32%	**12.**	$72.42	17%

72. *Find quotient, short method:*

1. $160 \div 25 = ?$ 6. $720 \div 37\frac{1}{2} = ?$ 11. $56 \div 80 = ?$
2. $240 \div 75 = ?$ 7. $420 \div 83\frac{1}{3} = ?$ 12. $120 \div 16\frac{2}{3} = ?$
3. $36 \div 8\frac{1}{3} = ?$ 8. $35 \div 87\frac{1}{2} = ?$ 13. $142 \div 40 = ?$
4. $96 \div 12\frac{1}{2} = ?$ 9. $180 \div 66\frac{2}{3} = ?$ 14. $130 \div 25 = ?$
5. $630 \div 33\frac{1}{3} = ?$ 10. $30 \div 62\frac{1}{2} = ?$ 15. $280 \div 87\frac{1}{2} = ?$

73. *Find the missing term:*

1. $3 : 8 = 37\frac{1}{2} : ?$ 6. $3 : 9 = 12\frac{1}{2} : ?$
2. $1 : 4 = ? : 50$ 7. $? : 8 = 87\frac{1}{2} : 100$
3. $6 : 5 = 120 : ?$ 8. $5 : 10 = 16\frac{2}{3} : ?$
4. $2 : 3 = 66\frac{2}{3} : ?$ 9. $7 : 6 = ? : 100$
5. $5 : 8 = ? : 100$ 10. $? : 8 = 112\frac{1}{2} : 100$

74. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
788	899	998	796	995	989
959	568	889	958	587	589
467	999	594	774	798	779
764	488	754	897	455	788
558	697	986	496	787	598
698	586	589	799	378	955
599	678	897	783	595	399
738	479	869	988	556	787
869	798	796	794	688	908
989	786	228	697	665	679

75.† *The Canning of Tomatoes.*

1. In 1914 the Girls' Canning Clubs of the United States had a membership of 33,173 girls, each of whom had $\frac{1}{10}$ of an acre under cultivation in tomatoes. How many acres did they cultivate in all?

2. Of the club members 7793 canned 6,091,237 pounds of tomatoes. What was the average number of pounds canned by each girl?

3. The tomatoes canned by the girls' clubs had an estimated value of $284,880. If this amount included a profit of $200,000, what was their per cent of profit?

4. In a certain year the canneries of the country had an output of 20,000,000 cases. Each case contained 24 cans weighing 2 pounds each. The whole was valued at $60,000,000. What was the value per can?

5. The standard 2-pound tomato can is $4\frac{7}{8}$ inches in height. If all the cans of tomatoes filled in the year 1914 by the canning factories were laid end to end, the row would extend nearly —— miles or nearly —— times around the earth at the equator.

6. When women are hired at $6\frac{1}{2}$¢ a pail for paring tomatoes, what will be the pay roll for 25 women for a week of 6 days if each pares on the average 34 pails each day?

7. How much does a man earn who stacks the cans, if he works from 7 A.M. to 9 P.M. taking $\frac{1}{2}$ hour at 12 and again at 6 for lunches? He is paid 45¢ an hour for 8 hours with double pay for each hour overtime.

8. A canning factory used one year 491,032 bushels of tomatoes. What did they pay for the tomatoes at $62\frac{1}{2}$¢ a bushel?

9. A canning factory shipped a carload of tomatoes containing 800 cases of 1 dozen cans each. In a wreck 3 % of the cans were crushed. What did the factory receive for the undamaged goods at 18¢ per can?

† See Table of Contents.

76. *Simple Interest Table.*

FOUR PER CENT

	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	$100	$1000
1 day......	0	0	0	0	0	0	0	0	0	0	1	11
3 days	0	0	0	0	0	0	0	0	0	½	3½	33
5 days	0	0	0	0	0	0	0	½	½	½	5½	56
10 days	0	0	0	½	½	½	1	1	1	1	11	1 11
1 month....	0	½	1	1½	1½	2	2½	2½	3	3½	11	1 11
2 months ...	½	1½	2	2½	3½	4	4½	5½	6	6½	67	6 67
3 months ...	1	2	3	4	5	6	7	8	9	10	1 00	10 00
4 months ...	1½	2½	4	5½	6½	8	9½	10½	12	13½	1 33	13 33
6 months ...	2	4	6	8	10	12	14	16	18	20	2 00	20 00
9 months ...	3	6	9	12	15	18	21	24	27	30	3 00	30 00
1 year......	4	8	12	16	20	24	28	32	36	40	4 00	40 00

FIVE PER CENT

	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	$100	$1000
1 day......	0	0	0	0	0	0	0	0	0	0	1	14
3 days	0	0	0	0	0	0	0	0	0	0	4	42
5 days	0	0	0	0	0	0	0	1	1	1	7	69
10 days	0	0	0	0	1	1	1	1	1	1½	14	1 39
1 month....	½	1	1	2	2	3	3	3	4	4	42	4 17
2 months ...	1	1½	3	3	4	5	6	7	8	8	83	8 33
3 months ...	1	2½	4	5	6	8	9	10	11	13	1 25	12 50
4 months ...	1½	3	5	7	8	10	12	13	15	17	1 67	16 67
6 months ...	2½	5	8	10	13	15	18	20	23	25	2 50	25 00
9 months ...	3¾	7½	11	15	19	23	26	30	34	38	3 75	37 50
1 year......	5	10	15	20	25	30	35	40	45	50	5 00	50 00

SIX PER CENT

	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	$100	$1000
1 day......	0	0	0	0	0	0	0	0	0	0	2	17
3 days	0	0	0	0	0	0	0	0	0	1	5	50
5 days	0	0	0	0	0	1	1	1	1	1	8	83
10 days	0	0	1	1	1	1	1	1	2	2	17	1 67
1 month ...	½	1	2	2	3	3	4	4	5	5	50	5 00
2 months ...	1	2	3	4	5	6	7	8	9	10	1 00	10 00
3 months ...	1½	3	5	6	8	9	11	12	14	15	1 50	15 00
4 months ...	2	4	6	8	10	12	14	16	18	20	2 00	20 00
6 months ...	3	6	9	12	15	18	21	24	27	30	3 00	30 00
9 months ...	4½	9	14	18	23	27	32	36	41	45	4 50	45 00
1 year......	6	12	18	24	30	36	42	48	54	60	6 00	60 00

Bankers and others who have occasion to compute interest frequently, save time by using interest tables.

From the table on page 184, find the interest on $1000 for:

1. 3 mo. 5 da. at 4%.　　　**4.** 5 mo. 3 da. at 6%.

2. 9 mo. 3 da. at 5%.　　　**5.** 2 mo. 5 da. at 4%.

3. 6 mo. 10 da. at 6%.　　　**6.** 4 mo. 1 da. at 5%.

7. Mark Dawson loaned $2000 for 1 year 3 months at 5%. What interest did he receive?

8. Find the interest on $350 for 3 months 3 days at 6%.

77. *Written Problems on Economy.*

1. The French people are noted for their economy. They make from skim-milk a powder known as *mammala*, which is exceedingly nutritious. Skim-milk is 91% water. How many pounds of *mammala* could be made from 45,000 pounds of milk after 3.6% of it, which was butter fat, had been removed?

2. Which is the cheaper method of harvesting 200 bushels of potatoes, and how much cheaper? (1) 240 hours' work by a group of boys using forks, at 25¢ an hour; or (2) 10 hours' work by a man using a horse and plow, at 80¢ an hour, assisted by 3 boys at 25¢ an hour for 10 hours.

3. Mrs. Watson can buy maple syrup at 45¢ a quart or in gallon cans at $1.50. If she needs one gallon, how much does she save in purchasing by the gallon?

4. A farmer left his farm wagon in the yard during the entire winter instead of keeping it in the shed. Consequently he was obliged to buy a new wagon at the end of 4 years. The wagon should have lasted him at least 8 years. If the wagon cost him $75, what price did he pay for his carelessness?

5. What per cent is saved by buying potatoes at $2.40 per bushel rather than at 70 cents per peck?

78. *Oral Problems.*

1. A family wished to buy a new library table. Which would be better and how much, to wait until they have on hand the cash price of $12 or to buy it on the installment plan paying $1 down and 75¢ a week for 20 weeks?

2. At the rate of 30¢ for 4 oranges, how many dozen oranges can be bought for $3?

3. An article weighing 9 pounds costs $1.80. How much will one weighing 90 pounds cost at the same rate?

4. What is the interest on $250 for 2 yr. 6 mo. at 4%?

5. Janet bought a pound of tea for 80¢, 4 pounds of sugar for 90¢, and had one half dollar left. How much money had she at first?

6. I bought a tooth brush for 45¢ and a cake of soap for 18¢. What change did I receive from a $2 bill?

7. If a motor car ran 3 miles while a train ran 5 miles, how far did the car go while the train ran 35 miles?

8. How much business must a commission merchant do to earn $120 if his commission is 3%?

9. A yard of cloth cost $$\frac{2}{5}$$; how much can be bought for $$\frac{3}{20}$$?

10. $33\frac{1}{3}$% of 18 is what per cent of 36?

11. 4 is $6\frac{1}{4}$% of what number?

12. How long will $500 be in earning $\frac{1}{5}$ of itself at 5%?

13. How much must I pay for 3 dozen bottles of extract at 60¢ per dozen and 10% off?

What per cent is:

14. 12 ounces of 1 lb.?

15. 16 quarts of 1 bu.?

16. 16 rods of 1 mi.?

17. 24 cu. ft. of 1 cu. yd.?

18. 160 sq. rd. of 1 A.?

19. 60 pounds of 1 ton?

20. $1\frac{1}{2}$ pecks of 1 bu.?

21. 5 pints of 1 gal.?

22. 18 things of 1 score?

23. 18 in. of 1 ft.?

79.† *Wheat*
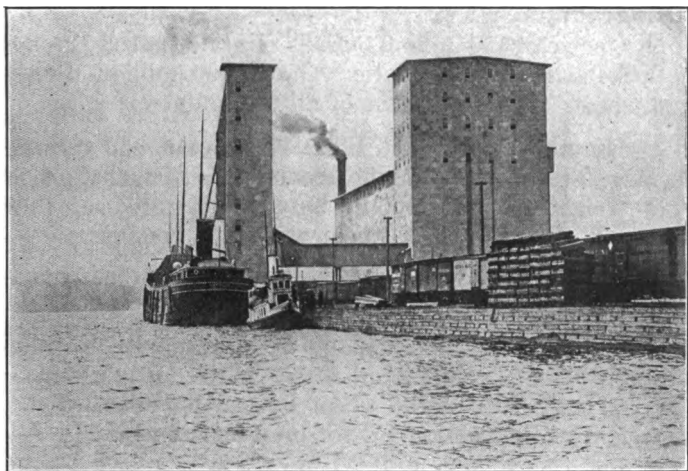
1. The average yearly production of wheat in the United States for a certain ten years was 659,509,000 bushels. This was approximately 20% of the entire crop of the world. How much was the world's crop?

2. Of the world's crop only 600,000,000 bushels got into the channels of international trade. What per cent of the wheat was used at home?

3. During the same period there was an average annual yield of 228,000,000 bushels of spring wheat raised in the Great Plains between the Mississippi River and the Rocky Mountains. This was 95% of the total amount of spring wheat raised in the entire country. How much spring wheat was raised in the entire country?

4. The amount of spring wheat raised in the United States was what per cent of the total amount raised in the Great Plains?

5. It is estimated that a train of the largest freight cars filled with the world's total production of wheat moving at

† See Table of Contents.

20 miles an hour, would take about 30 days to pass a given point. What would be the length of the train?

6. One year, 150 million bushels of grain passed through the locks at Sault Ste. Marie. Of this 90 million bushels were wheat. What per cent of all the grain was wheat?

7. Duluth, Superior and Buffalo, one year, had together 55 grain elevators with a joint capacity of 58,000,000 bushels. What weight of grain might have been stored in these elevators? One bushel of wheat weighs 60 pounds.

8. What is the freight bill for a car load of wheat weighing 48,000 pounds at 17¢ per hundred pounds?

9. The mills of one company in Minneapolis use more than 180,000 bushels of grain a day in the manufacture of flour. If only 70% of the wheat is used for flour, what is the weight of the portion left for bran and shorts?

10. What is the daily output in barrels of flour from this mill if it takes 5 bushels of grain for one barrel of flour?

11. If each barrel of flour yields 250 one-pound loaves of bread, the daily output of these mills would furnish what per cent of the people of the United States with a one-pound loaf each? Estimate the population of the United States at 100,000,000.

12. One year the average production of wheat in the country was $12\frac{1}{2}$ bushels per acre, which removed from the soil the following:

Nitrogen	Phosphoric Acid	Potash
23 lb.	13.6 lb.	24.1 lb.

To restore these elements to the soil, how many pounds of each of the following fertilizers would be necessary:

a. Nitrate of soda which yields 15.5% nitrogen?
b. Acid phosphate, which yields 14% of phosphoric acid?
c. Muriate of potash, which yields 50% of potash?

80. *Written Dictation.*

1. 4 × 7.5 = ?

2. 25.8 ÷ 6 = ?

3. A man who had $96 put 66⅔% of it in bank. How much did he deposit?

4. 9/10 of all the words given out in a lesson were spelled correctly and 8 were misspelled. Of how many words did the lesson consist?

5. An agent receives $72 for collecting a debt, his commission being 12½ per cent. What was the amount collected?

81. *Find at sight the interest and the amount on:*

1. $600 at 6% for 2 yr. 3 mo.
2. $500 at 6% for 5 yr. 6 mo.
3. $700 at 3% for 6 mo.
4. $300 at 4% for 4 yr. 6 mo.
5. $400 at 5% for 6 yr. 3 mo.
6. $150 at 6% for 4 yr. 1 mo.

82. *At sight:*

1. *a.* 3% of 45 = ?
   b. 97% of 45 = ?
2. *a.* 5% of 72 = ?
   b. 95% of 72 = ?
3. *a.* 12½% of 64 = ?
   b. 87½% of 64 = ?
4. *a.* 8% of 56 = ?
   b. 92% of 56 = ?
5. *a.* 4% of 81 = ?
   b. 96% of 81 = ?
6. *a.* 6% of 32 = ?
   b. 94% of 32 = ?

83. *Find cost:*

1. Selling price, 125%; gain, $20.
2. Selling price, 116⅔%; gain, 50 cents.
3. Selling price, 75%; loss, $3.
4. Selling price, 137½%; gain, $24.
5. Selling price, 98%; loss, $5.

84. *Find the value of:*

1. $\dfrac{4.5 \times .65}{9.1 \times .05} = ?$

2. $\dfrac{2.2 \times .24}{4 \times 7.7} = ?$

3. $\dfrac{5.6 \times 3}{63 \times .08} = ?$

4. $\dfrac{1.5 \times .06}{10 \times 3.6} = ?$

5. $\dfrac{6.3 \times 4.2}{2.7 \times .49} = ?$

6. $\dfrac{.21 \times .6}{2.8 \times 18} = ?$

85. *Written Problems.*

1. Mrs. Edgar Perkins set an incubator with 144 hens' eggs. At the end of 8 days she "tested out" $16\frac{2}{3}$% as infertile. How many remained? Of those remaining, 80% hatched out chickens. How many chickens were hatched? What per cent of the eggs set hatched out chickens?

2. At the end of 4 weeks, $6\frac{1}{4}$% of the chickens hatched had died. How many chickens were still alive? What percentage was this of the number of eggs first set?

3. I loaned $750 at 6%. After 1 yr. 8 mo. I received both principal and interest. How much money did I receive?

4. A firm went into bankruptcy having assets amounting to $17,400 and liabilities amounting to $43,500. The creditors received what per cent of the money due them?

5. A commission merchant sells goods upon which his commission at 3% amounted to $78. The freight was $47.23 and storage $35.60. Find the amount remitted to the consignor.

6. It requires 12 hours and 30 minutes for a through freight to run from Chicago to Indianapolis. Its average rate per hour is 14.72 miles. What is the total distance?

7. At $1.25 a yard, what is the cost of carpeting a room that is 15 feet by 18 feet, the carpet being a yard wide?

8. A city passenger agent was promoted to the position of district passenger agent, receiving an advance in salary of 25% or $60. What was his salary both before and after the promotion?

9. What amount will settle the following bill of house furnishings, the bill being subject to a discount of 20% and 10%: 8 dining room tables at $30; 12 sets of dining room chairs at $37?

10. The area of the Pacific Ocean is 50,307,000 square miles. This is 205% of the area of the Atlantic Ocean. What is the area of the latter?

11. A train of 30 cars carries 20 cattle per car. The average weight of the cattle is 1250 pounds each. How much will the train load bring at $16 per hundred weight?

12. A crop of cotton weighed $9\frac{1}{2}$ tons. From this 5700 pounds of seed were extracted. The weight of the seed was what per cent of the weight of the entire crop?

13. How many yards of leather upholstering 60 inches wide must be purchased for 20 foot stools, if it takes a piece 12 inches square for each stool?

14. An automobile truck weighing 7480 pounds carried a load weighing 11,220 pounds. The load was what per cent of the entire weight?

15. 1 ft. 3 in. is what part of 1 yd. 9 in.? 1 yd. 9 in. is what per cent of 1 ft. 3 in.?

16. A merchant sold a house for $7360, losing 8%. For how much should he have sold it to gain 5%?

17. If 5% more is gained by selling a motor car for $1300 than by selling it for $1250, what is the cost of the car?

18. At 50¢ a square yard, what will it cost to plaster the walls and ceiling of a room 21 ft. long and 18 ft. wide and 9 ft. high?

19. A clerk's salary was increased $8\frac{1}{3}$%. He then receives $2600. What was his salary before the increase?

20. Find the difference between $\frac{1}{4}$% of $1200 and 25% of $1200.

21. My property is assessed at $7000, the tax rate being $2.20 on $100. What is my tax if I pay a poll tax of $2?

22. A furniture dealer had $600 and spent 25% for bedsteads. With the remainder he bought 150 chairs. What was the price of each chair?

23. What was the monthly water bill for an apartment for 15,460 cubic ft. of water ($7\frac{1}{2}$ gal. to the cu. ft.) at 18¢ a thousand gallons?

86. *City Bakery.*
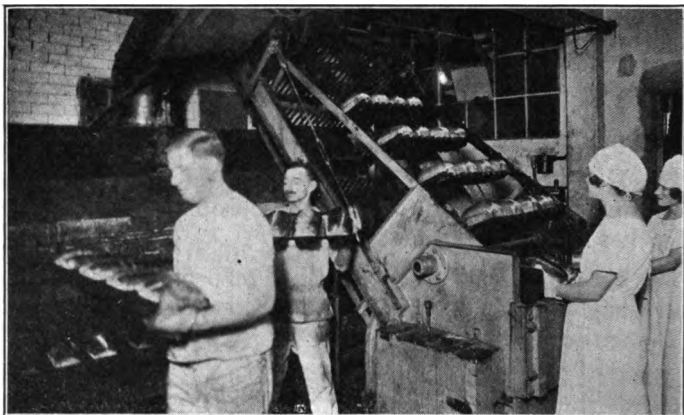
1. If a bakery whose output is 150,000 loaves a week spends $10,000 for flour, $600 for other material, and $1400 for labor, what is the average cost of production per loaf?

2. What per cent of the total cost of production is the cost of the flour?

3. If this bakery sells to local grocers at 9¢ a loaf, what is its per cent of gain?

4. The grocers in turn sell 92% of the fresh bread at 10¢ a loaf and the remainder as stale bread at 8¢ a loaf. What is their profit?

5. If the price of flour advances from $7.50 to $12 a barrel, for what should a loaf of bread which previously sold for 5¢ be sold, to correspond with this rise in the price of the flour?

6. If, in the foregoing problem, 12 ounces of flour per loaf were used when it was $7.50 per barrel, how many ounces should be used when flour is $12 per barrel to keep the price per loaf at 5¢?

7. Which of the methods indicated in problems 5 and 6 does a baker employ?

8. Imagine yourself the bookkeeper of a Bakers' Supply House. Make out and receipt the following bill to the Bryce Baking Company, allowing discounts of 10% and 5%; 100 barrels of flour at $9.50; 150 pounds of raisins at 17¢; 372 pounds of molasses at 15¢.

9. How many persons can be served with two macaroons each, from 3 boxes containing 5 rows of macaroons of 4 layers each with 35 in a layer?

10. At one time $21 would buy a barrel of sugar weighing 350 pounds. How many pounds would $21 buy after sugar had advanced to $28 a barrel?

11. A baker buys 480 dozen eggs at 31¢ a dozen. $12\frac{1}{2}\%$ of these are broken in shipping (a loss to the shipper). What would be the amount of the bill, allowing 5% discount for cash?

12. If a machine cuts 250 crackers in one minute when running at half speed, how many can it cut in one day of 8 hours when running at full speed?

13. Crackers are baked in sheets 6 crackers wide and 16 crackers long. If 5 sheets are turned out of the oven each minute, what is the output per hour?

14. A woman packs 4 boxes of crackers in 30 minutes. At this rate, how many women will it take to pack 200 boxes in 5 hours?

15. A biscuit company bought 1850 barrels of flour at $12 a barrel with discounts of 15 and $4\frac{1}{2}\%$. What was the net cost?

16. Find the per cent of gain on a box of cakes weighing $9\frac{1}{2}$ pounds which sold for $2.66 when the materials cost 20¢ a pound.

87. *Oral Problems.*

1. *Chain problems for oral dictation:*

a. $(8 \div 4 \times 72 \div 12) + 3 \times 10 \div 3 = ?$

b. $(\frac{3}{4} \times 24 \times 2) + (6 \times \frac{5}{6}) + (35 \div 70) = ?$

c. $5 \times 9 \div 15 \times 33\frac{1}{3} \times 8 \div 25 \times \frac{1}{8} = ?$

d. $2 \times 8 \div 2 + (64 \div 9 \div \frac{1}{3} + 6) = ?$

e. $24 \div 32 \times 12 \div 4\frac{1}{2} \times 2 \times 12 \div 9 = ?$

f. $\frac{1}{2} + (\frac{3}{4} \times 16 \div 5 \div 2 \times 14) = ?$ Continue.

2. 8 is 100% more than what number?

3. What shall I pay for $16\frac{2}{3}$ pounds at 18¢ per pound?

4. A man divided $\$8\frac{2}{3}$ among his children, giving them $\$1\frac{1}{3}$ each. How many children had he?

5. Gave \$6 for a bunch of 100 bananas. What per cent was gained by selling them at 2 for 15¢?

6. How many 4-ounce packages of nutmegs can be made up from $12\frac{1}{4}$ lb.?

7. My agent sent me 95% of what he had collected and kept \$20. How much had he collected?

8. If $\frac{2}{3}$ of a yard cost $\$\frac{4}{5}$, how much can be bought for \$1?

9. How must coffee that cost 30¢ a pound be sold to realize a profit of $16\frac{2}{3}\%$?

10. Express the ratio in percentage of 3 quarts to 3 gallons; of 3 gallons to 3 quarts.

11. A man wishes to build a 40-foot fence across the front of his lot. What will the posts cost at \$1.25 each, if they are 8 feet apart? Drawing.

12. If 100% is gained by selling an article for \$1, how much would be gained by selling it for \$2?

13. At $66\frac{2}{3}$¢ each, how many articles will \$8 buy?

14. $\frac{3}{4}\%$ of a number is 9. What is the number?

88. *Written Problems.*

1. A storekeeper sold his goods at an advance of 20%. What was the ratio of the selling to the buying price?

2. A manufacturer sold 20 pieces of velvet at auction at $30 per piece. On $\frac{1}{4}$ of them he gained 20% and on the rest he lost 20%. How much did he lose by the sale?

3. Alice Boyer is allowed a 10% discount in the store where she is a clerk. She paid $3.60 for a hat. *a.* What was the sale price of the hat? The sale price of the hat was 20% reduction on the price the hat was originally marked. *b.* What had been the original marked price of the hat? By selling the hat to Alice for $3.60, the firm still made a profit of 20%. *c.* What had been its cost to the firm? *d.* Had the firm sold at the original marked price, what would have been the per cent of gain?

4. If $9000 yield $1350 interest in three years, what will be the interest on $1800 for the same time at the same rate of interest?

5. I bought a ham at 46¢ a pound. The waste is 10%. How must I sell to gain 25%?

6. If I travel $2\frac{2}{3}$ miles in one half hour, how far will I travel in $2\frac{1}{2}$ hours at the same rate?

7. A man sold a sewing machine for $27 and lost 25%. If he had sold it for $39, what per cent would he have gained or lost?

8. A town, valued at $4,800,000, levied a tax of $120,000. How large a tax must a man pay who owns $5600 worth of property, assessed value?

9. If $22\frac{1}{2}$ yards of cloth cost $36, what will $67\frac{1}{2}$ yards cost?

10. An agent sold 480 crates of berries at $2.35 a crate, charging $4\frac{1}{2}$% commission. The other charges were $21 freight, and $5 for cartage. How much money should the agent return to his employer?

11. An agent collected 80 % of a debt of $3600 for me and charged $3\frac{1}{2}$% commission. How much did he pay me?

12. A farmer raised 6824 bushels of grain. By fertilizers he increased the yield $8\frac{3}{4}$%. What was the yield then?

13. A railway train, running at the average rate of 35 miles an hour for $2\frac{4}{5}$ hours, passes over 35% of the conductor's run. What is the length of his run?

14. An agent sold the following consignment of goods:

35 pounds creamery butter @	$ .58
40 pounds cheese @	.50
19 barrels of potatoes @	5.75

Find the agent's commission at $6\frac{1}{4}$%.

15. A farmer exchanges 20 bushels of apples at $1.50 per bushel for coal at $7.50 per ton. How many tons does he receive?

16. A real estate dealer bought a house and lot for $1650. The house was remodeled at a cost of $800 and $250 was paid for street improvements. He then exchanged the property for 40 acres of land which he immediately sold at $80 an acre. What was his per cent of gain?

17. A man sells $\frac{5}{8}$ of an acre of land for $75. What would be the value of his farm of $50\frac{3}{4}$ acres at the same rate?

18. A farm hand agrees to work for $390 per year and a horse worth $60. If he leaves at the end of 9 months, how much is due him if he has already received $100 and the horse?

19. A lawyer received $76.04 for collecting a debt of $950.50. What was his rate of commission?

20. A man purchased 60 bushels of apples at $2.50 per bushel. Twenty-five per cent of them were damaged. He sold the damaged apples at 20¢ per peck and the remainder at 80¢ per peck. How much did he gain or lose?

21. The perimeter of a room is 58 ft. 6 in. How many strips of paper 18 inches wide are needed for the walls?

22. The tax rate in Aldensburg for 1913 was $2.08 on each $100. Poll tax, $2.50. How much tax was paid by Mr. Jessup, whose property was assessed at $2550, and who also paid a poll tax?

23. I sold goods for $400. After paying 3% commission to the auctioneer, I found that I had made a net gain of $33\frac{1}{3}\%$. What did the goods cost me?

24. At $60 an acre, find the cost of a field 60 rods long and 40 rods wide. Represent the lot, using scale, 1 inch = 20 rods.

25. An agent is paid $6 for selling eggs, which is a commission of $\frac{1}{4}\%$. How much does he get for the eggs?

26. Imagine that you have rented a house to a classmate. Write out a receipt for a month's rent, which he has just paid to you.

27. How old to-day is a boy who was born October 29, 1917?

28. How many strips of 27-inch carpet will be required for a room 15 ft. 9 in. wide, if the strips run lengthwise?

29. Write a promissory note, making yourself the payer and a classmate the payee. The face of the note is $300.

30. A house and lot cost $4750, the insurance is $25, taxes are $50, and repairs average annually $75. What monthly rent must be received in order to realize 6% on the entire outlay?

31. An express train runs 240 miles in $5\frac{1}{4}$ hours. At this rate how far will it run in $3\frac{1}{2}$ hours?

32. At $.36 per sq. yd., what will it cost to paint a blackboard 25 ft. by 4 ft.?

33. If 1 bu. 2 pk. of rye are sown per acre, how much seed is required to sow 6 acres?

34. A man bought 12¼ acres of land at one time and 23½ acres adjoining at another time. Into how many lots of 1⅜ acres each can this land be divided?

35. A carpenter works 5½ days at $6 a day, but breaks a saw worth $2.75 and loses a hammer worth $1.10. What does he have left from his week's wages after deducting the value of the saw and hammer?

36. If 15 bales of hay weighed 1 ton 7 cwt., what was the average weight per bale in pounds?

37. One girl lives on the National Road 370 mi. west from Washington; another lives 280.65 miles in the same direction. How far apart do they live?

38. A railway station in Peru is 16,635 feet above the sea level. This is how much more than three miles?

39. You bought 160 acres of land from A. B. Clarke at $81.50 per acre. You paid $3040 cash. For the balance you gave two equal notes payable in one year and two years respectively. Interest 6%. Amount due?

40. Find the cost of 7680 bricks at $12 per M.

41. Find the number of feet of picture molding required to go around a square room 15 feet 9 inches on a side.

42. The half of a number added to its fourth part equals 27. What is the number?

43. What is the bank discount on a note for $875 due in 1 yr. 6 mo. at 5% interest, discounted at the bank for 90 days at 6%?

44. How much will it cost to plaster a room 18 ft. long, 15 ft. wide and 9 ft. high at 50¢ a square yard, after deducting 108 square feet for doors and windows?

45. What would be the cost of 125,000 stamped envelopes at $21.30 per thousand?

Test Page I

    This page and the one following contain types of exercises which the class should do readily before proceeding to the work of Part II, Section Two. A class percentage of not less than eighty should be required.

I

Write answers only:

  1. *a.* Write in Roman numerals: 1920.

      b. Write in words: 94,049.   (Teacher write figures on board.)

  2. *a.* $27 + 75 = ?$

      b. $2\frac{3}{4} \times 60 = ?$

  3. James is 3 years old and his uncle is 50 years old. James's age is what per cent of his uncle's age?

  4. If $\frac{2}{3}$ of a ton of coal costs $6, what is the cost of $1\frac{1}{3}$ tons?

  5. What is the interest on $300 for 2 yr. 4 mo. at 6%?

II

Show all work — time limit 25 minutes:

  1. A man carried to a store $5\frac{1}{2}$ bushels of potatoes and received for them $1.80 per bushel. How many pounds of bacon at 50¢ a pound did he get in exchange?

  2. How many sheep at $9.75 each should be given in exchange for 45 horses worth $195 each? Cancellation.

  3. If $\frac{3}{4}$ of a farm is worth $2480, what is $\frac{3}{8}$ of it worth?

  4. How many sofa pillow covers 18 inches square can be cut from a piece of felt 6 feet by 4 feet 6 inches?

  5. The population in a certain town one year was 4592. This was an increase of $16\frac{2}{3}$% over the previous year. What had been the population the previous year?

Test Page II

III

Oral Problems

Before solving, name the operation to be used.

1. A woman bought $2\frac{1}{2}$ yards of $12\frac{1}{2}$¢ muslin and gave the clerk a dollar. How much change did she receive?

2. How many barrels of apples at $7 each can I buy for $96 and have $12 left?

3. The rate of taxation in a certain town is $2.18 on each $100. How much tax does a man pay who is assessed on $1000 worth of property and pays $2 poll tax?

4. An attorney collects an account of $60 for Mr. Elliott, charging $8\frac{1}{3}\%$ commission. How much money does Mr. Elliott receive?

IV

Write at dictation:

1. Add: $888 + 687 + 349 + 687 + 399 + 789 + 868 + 969 + 378 + 978$ (two minutes).

2. Multiply 8690 by $439\frac{5}{8}$ (three minutes).

3. Divide 31,272.28 by 38.9 (three minutes).

4. Find the value of: $\dfrac{7\frac{1}{5} \times 6\frac{7}{8}}{\frac{1}{8} + \frac{5}{6}}$ (four minutes).

V

Each child one exercise (oral).

1. $77 + 39 = ?$
$120 \div 33\frac{1}{3} = ?$
7 is what % of 84?
$7\frac{1}{2} - 2\frac{1}{3} = ?$
$\frac{4}{5} \times 1\frac{2}{3} = ?$

2. $5\frac{1}{4} - 3\frac{1}{2} = ?$
18 is what % of 24?
$210 \div .87\frac{1}{2} = ?$
$\frac{7}{8} \times 1\frac{3}{4} = ?$
$83 + 28 = ?$

3. $200 \div .83\frac{1}{3} = ?$
$58 + 37 = ?$
12 is what % of 32?
$8\frac{1}{3} - 2\frac{1}{4} = ?$
$\frac{5}{6} + 1\frac{5}{8} = ?$

4. $30 \div \frac{3}{4} = ?$
27 is what % of 81?
$2\frac{3}{4} \times 80 = ?$
15 % of 60 = ?
$6\frac{1}{3} - 4\frac{1}{2} = ?$

PART TWO — SECTION TWO

1. *Taxes — continued.*
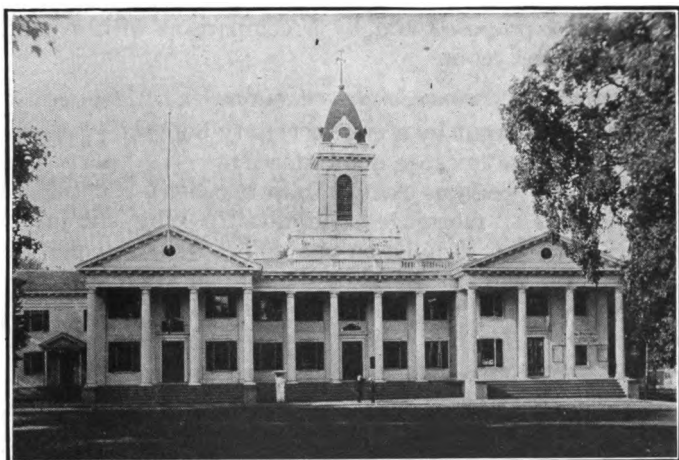
President of Town Council: Gentlemen, we have before us this evening the consideration of the rate which we must levy for next year's taxes.

Mr. Brady: What is the proposed budget for next year?

Mr. Bell (the secretary) reads:

Expenses for Schools...	$29,500	Town Officers.......	$2500
Expenses for Library...	2,200	Police and Fire De-	
Roads and Bridges ...	2,300	partments........	4,700
Parks and Lighting....	3,400	Incidentals........	6,200

This makes a total of $—— for our city expenses. We have also to pay $7500 state tax and $4500 county tax. From this grand total poll taxes amounting to $2800 will be subtracted.

President: What is the total assessed value of the town property?

Mr. Bell: The assessor's books show a valuation of $3,000,000. Since we must raise $———, if you agree to the proposed budget, our rate next year will be ——— mills on one dollar.

Continue the meeting by discussing the wisdom of the expenditures proposed and by a comparison with expenditures in former years.

2. *Suggestive Questions for Investigation.*

   1. What is meant by a city or county budget?

   2. How is the tax rate determined?

   3. What property is exempt from taxation?

   4. What is a "mortgage exemption"? Why is it just?

   5. If taxes are 15 mills on one dollar, what rate per cent are the taxes? What would be the rate on $100?

   6. What is the rate per cent assessed in your city or county?

3. *Written Problems on Taxes.*

   1. In a city where taxes may be paid in two equal installments prior to March 1 and August 1, a certain property is assessed at $15,600, the tax rate for the year being 14 mills. How much must be paid prior to March 1?

   2. The assessed valuation of the property of a certain town is $300,000. The tax to be raised is $6000. What is the rate of taxation?

   3. What must be paid by Mr. Burton, who owns $7500 worth of property in the town?

   4. How large will be my tax if I am assessed for $8000 at the rate of 14 mills?

   5. Mr. Mathews paid a tax of $162 of which $2 was poll tax. If the tax rate was $12\frac{1}{2}$ mills, what was the assessed valuation of his property?

   6. Mr. Ralston's property is assessed at $9750. The rate of taxation is $1.74 on $100. His poll tax is $2. What was his total tax?

4. *At sight:*

1. Base $640	Rate 2%	Percentage ?
2. Rate 4%	Percentage $24	Base ?
3. Base $560	Percentage $70	Rate ?
4. Percentage $50	Rate 10%	Base ?
5. Rate $12\frac{1}{2}$%	Base $240	Percentage ?
6. Base $360	Rate 2 %	Percentage ?
7. Percentage $25	Base $150	Rate ?

5. *Complete the proportion:*

1. $1:4 = 6\frac{1}{4}:$?

2. $1:? = 12\frac{1}{2}:37\frac{1}{2}$

3. $1:5 = ?:83\frac{1}{3}$

4. $1:? = 12\frac{1}{2}:62\frac{1}{2}$

5. $1:7 = ?:87\frac{1}{2}$

6. $2:3 = ?:37\frac{1}{2}$

7. $2:? = 33\frac{1}{3}:50$

8. $2:3 = 66\frac{2}{3}:$?

9. $3:? = 37\frac{1}{2}:62\frac{1}{2}$

10. $5:7 = ?:87\frac{1}{2}$

6. *Complex Fractions.*

1. $\frac{\frac{4}{5}}{\frac{1}{2}}$

2. $\frac{\frac{8}{3}}{7}$

3. $\frac{5}{\frac{2}{3}}$

4. $\frac{\frac{7}{8} - \frac{2}{3}}{\frac{2}{3} + \frac{1}{2}}$

5. $\frac{\frac{1}{2} + \frac{3}{4}}{\frac{1}{2} \times \frac{3}{4}}$

6. $\frac{\frac{2}{3} \times \frac{3}{4}}{\frac{1}{2} \div \frac{1}{4}}$

7. $\frac{33\frac{1}{3} - 16\frac{2}{3}}{100 \div 12}$

8. $\frac{12\frac{1}{2} + 8\frac{1}{4}}{21\frac{3}{4} - 6\frac{1}{8}}$

9. $\frac{83\frac{1}{3} + 16\frac{2}{3}}{\frac{1}{2} \times \frac{1}{4} \div \frac{1}{8}}$

7. *Add:*

1. $576.8 + 35.654 + 9866 + 99.8789 + 6.837 + 586.5498 + 77.2$

2. $778 + 6.92 + 446.5 + 6.866 + 98.7689 + 99.8765 + 497.5678$

3. $6.59 + 68.884 + 39.8549 + .0896 + 2967.9 + 767 + 8986.545$

4. $9.7 + 69.857 + .8969 + 787.75 + 8964.9778 + 6.7 + 8885.545$

5. $8.98 + 79.885 + 489 + .9965 + 8965.898 + 786.65 + 98.8649$

8. *Written Problems.*

1. If the interest on $75 at 6% for a certain time is $6.75, what is the interest on the same sum for the same time at 9%?

2. Reduce .625 of a mile to units of lower denomination.

3. Find the area in square feet of a walk 4 feet wide around a rectangular flower bed that is 40 feet long and 12 feet wide. Make a drawing.

4. What is the net cost of a number of musical instruments amounting to $2100, on which discounts of $10\frac{1}{2}$% and $2\frac{1}{2}$% are allowed?

5. What sum shall a man invest at $5\frac{1}{2}$% in order to give his family an annual income of $1650?

6. A coal dealer buys 475 tons of coal at $5 per ton of 2240 pounds. He sells it at $7.50 per ton of 2000 pounds. What is his profit?

7. If oranges are 75¢ per dozen, how many boxes, each containing 480 oranges, can be bought for $60? Cancellation.

8. What will be the cost of 76,400 feet of gas at $.55 per thousand feet?

9. A man died in 1913, aged 94; his son died in 1907, aged 57. How old was the man at the birth of his son?

10.† Fresh air enters a room through an opening 8 inches by 14 inches with a velocity of 5 feet a second. How many cubic inches of air will enter the room in one second?

11. A man had property assessed at $9500. What will be his taxes at the rate of $10.80 per thousand dollars?

12. A man bought a farm of 196 acres for $9800 and after spending $980 for improvements, sold it at $66 an acre. What was his per cent of gain?

13.† How many gallons of water are held by a circular cistern whose diameter is 5 feet and whose depth is 8 feet? (231 cubic inches in a gallon.)

† See Table of Contents.

14. A schoolroom is 28 feet wide, 30 feet long and 15 feet high. The area of one end wall is what per cent of the area of one side wall?

15. What would it cost to plaster the walls and the ceiling of the room in the preceding problem at 24¢ a square yard, allowing 56 square yards for openings?

16. If a church steeple 150 feet high casts a shadow 275 feet long, how long a shadow will be cast by a man 6 feet tall at the same time of day?

17. How many feet of wire fencing shall I need for a field 16 rods wide and 18 rods long, using 4 rows of wire?

18. What is the area of a triangle whose base is 21 feet 8 inches and whose altitude is 19 feet 6 inches?

19. A school district is to build a new school at a cost of $40,000. The assessed valuation of the property is $20,000,000. How much will Mr. Clarke pay toward the building if his property is assessed at $35,000?

20. Mr. Allison bought a house and lot for $6000. He paid $900 cash and gave three notes of equal amounts for the balance due in 4, 8 and 12 months, with interest at 6%. How much is due at each payment?

21. A real estate man traded a lot 40 feet wide at $240 a front foot, for a western farm of 80 acres. How much is the farm worth per acre?

22. What per cent is gained on an article bought for 20% less than its value and sold at 25% more than its value?

23. A farmer bought a field of $16\frac{1}{2}$ acres at $37\frac{1}{2}$ per acre and sold it at $45\frac{1}{4}$ per acre. How much did he gain?

24. If I sell goods at a commission of $8\frac{1}{3}\%$, what must be the amount of my sales in order that I may receive $2800 annually?

25. What is the compound interest on $460 for 1 yr. 6 mo. compounded semiannually at 4%?

9.* *Algebra — Introductory.*

1. Louis bought 6 oranges at 5¢ each. How much did he pay for them? At n¢ each? **Ans. 6n.** The multiplication sign is usually omitted in algebra.

2. Paul works for b dollars a day. How much does he earn in 5 days?

3. If you are t years old, how old is your mother, who is 3 times as old as you?

4. If a square is b inches on each side, what does $4b$ represent?

5. In one meadow are x cows and in another y cows. How many cows in both meadows? **Ans.** $x + y$ cows.

6. Indicate the sum of 6 and 9; of a and 7; of b and c; of m, n and o; of $3x$, $4y$ and 17.

7. *For study.*

a. How many rods of fence will be needed for a lot 3 rods wide and 5 rods long?	*b.* How many rods of fence will be needed for a lot a rods wide and b rods long?
Solution	Solution
(3rd. + 3rd.) + (5rd. + 5rd.) = 16 rd. length of fence required.	(a rd. + a rd.) + (b rd. + b rd.) = $2a$ rd. + $2b$ rd. length of fence required.

8. A man is x years old to-day.

a. How old will he be 7 years from now? **Ans.** x + 7 years.	*b.* How old was he 5 years ago? **Ans.** x − 5 years.

9. When b represents an odd number, what will represent the next larger odd number? The next smaller odd number?

10. Mr. Runyan sold a horse for t dollars and gained s dollars. How much had the horse cost him? Let t = $225; s = $60.

11. Mr. Bruce bought m cows at d dollars a head and n sheep at c dollars a head. What did they all cost him? Supply values.

Read the Preface and the Table of Contents. Lessons marked * should be assigned for study previous to the recitation. See Suggestions to Teachers.

12. The length of a box is 3 times its width. Its width is g. What is its perimeter? Let $g = 6$.

13. Fred paid y dollars for his shoes and twice that amount for his overcoat. What did he pay for his overcoat? Let $y = \$4$.

14. *For study.*

a. How many square rods in a lot 3 rods wide and 5 rods long?

b. How many square rods in a lot x rods wide and y rods long?

Solution

3×5 sq. rd. $= 15$ sq. rd.
There are 15 sq. rd. in the lot.

Solution

x times y sq. rd. $= xy$ sq. rd.
There are xy sq. rd. in the lot.

15. How many square inches in a rectangle c inches long and d inches wide? Prove with $c = 3$; $d = 4$; with $c = 5$; $d = 6$.

16. Draw a rectangle; write m for its base and t for its altitude. Express the area of the rectangle. Express its perimeter. Prove the correctness of your statements by substituting 7 for m and 9 for t.

17. Goods that cost b dollars were sold at a profit of d dollars. What was the selling price?

18. Some goods costing r dollars were sold at a gain of 25%. State the selling price.

19. There are l dollars in one bank and \$200 more than twice as much in another. How many dollars in the second bank?

20. What is the value of $2y + 3$ when $y = 7$; 3; 9; 12?

21. A rectangular bin is m ft. long, n ft. wide and o ft. deep. Give cubical contents.

22. What is the value of $\frac{r}{2}$ when the value of r is 12?

23. What is the value of $3z$ when the value of z is 5?

24. There are k pupils in a class. This is 14 fewer than the number of pupils in a second class. How many pupils in both classes?

10. *Oral Problems.*

1. When taxes are $14 on one thousand dollars, **how** much are they on one hundred dollars? On one dollar? What is the rate per cent?

2. At 16⅔¢ a yard, how many yards of cloth can be bought for $6.50?

3. An agent received $72 for collecting a debt, his commission being 12½%. How much was the debt?

4. In making bread, a baker allows 1 pint of water to a pound of flour. How many gallons of liquid will he use with one barrel of flour? There are 196 pounds of flour in a barrel.

5. If a farm hand carelessly covered 20 hills in an acre in cultivating young corn, what was the value of the corn destroyed, counting 2 ears to the hill and 100 ears to the bushel at $1.75 per bushel?

6. What annual rate of income have I on a $9600 house rented at $80 a month?

7. A man bought 60 cords of wood for $200. He sold them at a loss of 10%. At what price did he sell per cord?

8. If ⅚ of a yard of cloth costs $3, what will 5 yards cost?

9. $\frac{1}{12}$: ? = 8 : 16.

10. What is the interest at 6% on $75 for 2 months?

11. In 4 pounds of dried corn there are 8 ounces of water. How many pounds of water in 100 pounds of dried corn?

12. I sold a horse for $210, which was 12½% less than it cost. What had the horse cost me?

13. An agent sells a book for $4, receiving a commission of 40%. How much does he remit to the publisher?

14. If a roll of carpet containing 75 yards is worth $150, what are 15 yards worth?

15. By selling 3 quarts of milk for the price of 1 gallon, I gained what per cent?

11. *Banking — Questions for Investigation.*

1. What would happen if a large per cent of the people in a country put their savings into safety deposit boxes?

2. How can a banker afford to keep your money in safety, pay men to handle it, keep the accounts and charge you nothing for this care?

3. What does the banker do with the money which is deposited in his bank?

4. How can a check be made payable to a person not named on the face of the check?
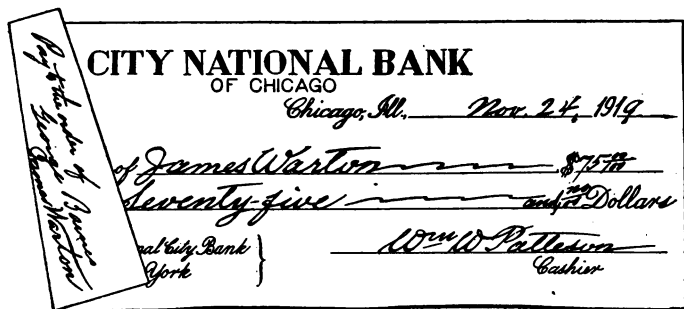
5. Why are most checks made payable to the order of the person named on the face of the check?

6. Why do the banks furnish check books containing stubs to their regular customers?

7. What is meant by getting your balance?

8. What are returned to you with your balanced statement?

9. Why should a returned check be saved if one has no other receipt?

10. Why does the banker object to your overdrawing your account?

11. Why do banks use adding machines and interest tables?

12. What is a certified check? When are such checks necessary?

13. What is a certificate of deposit? How long must you leave your money in the bank before you can draw interest on it? What is the rate of interest on a certificate of deposit?

14. What is meant by legal rate of interest? What is usury?

15. If you wish to send money by check to pay an account in another city, how do you obtain the check? What is the exchange?

16. What is a Bankers' Association? How does it make all banks belonging to it safer places of deposit?

17. Why does the federal government inspect banks at regular intervals?

18. What is the difference between a national bank and a private bank?

19. By whom is a state bank supervised?

12. *Multiplying a Decimal by* 10 *or a Multiple of* 10. *At sight.*

1. 10×5.56	**7.** $.05 \times 1000$	**13.** $.42 \times 3000$
2. $10 \times .609$	**8.** $.25 \times 2000$	**14.** 1.5×5000
3. 10×60.9	**9.** 5.5×1000	**15.** 30×23.40
4. 14.7×10	**10.** $.49 \times 3000$	**16.** $.25 \times 1000$
5. $.246 \times 20$	**11.** 40×32.6	**17.** 4.5×2000
6. 23.8×30	**12.** 20×7.03	**18.** 30×1.200

13. *Written Dictation.*

1. $83\frac{1}{3}\%$ of 24 is what per cent of 25?

2. $9.2 - 7.8 = ?$

3. After selling 5.7 acres of land, Mr. Adams has 12.4 acres remaining. How many acres had he at first?

4. A grocer sells coffee at 40¢ a pound and thereby gains $33\frac{1}{3}\%$. What is the cost of the coffee?

5. In Brownsburg there are 1200 school children. This is 20% of the total population. What is the population of the town?

14.* *Computing Interest — Banker's Method.*

The Banker's Method of computing interest is the one used in practically all large business establishments. For that reason pupils should become thoroughly familiar with it. Note that all the computations can be performed without pencil.

The interest on $1 for 2 months at 6 % is $0.01.

1. What is the interest for 2 months at 6% on:

a. $650   *b.* $5000   *c.* $8627   *d.* $27

The interest on $1 for 6 days at 6 % is $0.001.

2. What is the interest for 6 days at 6% on:

a. $650   *b.* $5000   *c.* $8627   *d.* $27

3. *For study.* What is the interest on $624 for 7 months 14 days at 8% per annum?

$6.24 is the interest for 2 mo. at 6 %.
.624 is the interest for 6 da. at 6 %.

Write		Think	
$18.72	Int.	6 mo.	at 6 % (3 × $6.24)
3.12	Int.	1 mo.	at 6 % ($\frac{1}{2}$ of $6.24)
1.248	Int.	12 da.	at 6 % (2 × $.624)
.208	Int.	2 da.	at 6 % ($\frac{1}{3}$ of $.624)
$23.296	Int. 7 mo. 14 da.		at 6 %
7.765	Int. 7 mo. 14 da.		at 2 % ($\frac{1}{3}$ of $23.296)
$31.06	Int. 7 mo. 14 da.		at 8 %

The interest on $624 for 7 mo. 14 da. at 8 % is $31.06.

Find the interest on:

4. $785 for 5 mo. 17 da. at 6%.

5. $8750 for 9 mo. 15 da. at 3%.

6. $968 for 4 mo. 24 da. at 8%.

7. $797 for 1 yr. 3 mo. 15 da. at 7%.

8. $985 for 2 yr. 5 mo. 12 da. at 4%.

15.* *Algebra — The Equation.*

An *equation* is the statement of the equality of two quantities. $4 + 5 = 3 \times 3$. The numbers on the right of the equality sign form the *right member* of the equation (3×3), and the numbers on the left, the *left member* $(4 + 5)$.

Find the unknown number in each of the following equations:

1. *a.* $7 - ? = 5$ **3.** *a.* $\frac{21}{3} = ? + 5$ **6.** $15 - x = 8$

    b. $7 - b = 5$ *b.* $\frac{21}{3} = y + 5$ **7.** $18 + x = 24$

2. *a.* $8 \div 2 = 1 + ?$ **4.** $n \div 3 = 9 - 5$ **8.** $30 - x = 21$

    b. $8 \div 2 = 1 + s$ **5.** $x + 3 = 10$ **9.** $32 = x + 4$

10. *For study.* A tree 72 feet high was broken off by the wind so that the part broken off was 3 times the length of the part standing. What was the length of the part standing?

Solution

Let x = length of part standing.
Then $3x$ = part broken off.
$x + 3x = 72$ feet.
$4x = 72$ feet.
$x = 18$ feet.
The length of the part standing was 18 feet.

11. One number is 5 times another and their difference is 12. What are the numbers?

12. A father is 3 times as old as his son. The sum of their ages is 52 years. What is the age of each?

13. The length of a rectangle is 4 times its width and the perimeter is 30 yards. Find the dimensions.

16.* † *Exact Interest.*

Exact interest is used by the United States government, by some banks, and to some extent in other business transactions. In ordinary interest 360 days are reckoned to the year. In exact interest we take the exact number of days between dates and reckon 365 days to a year.

1. *For study.* Find the exact interest on $3500, at 5%, from April 20 to September 15.

<div align="center">Solution</div>

148 days = number of days from April 20 to Sept. 15.

$$\frac{5 \times 148 \times \$3500}{100 \times 365} = \$70.96$$

The exact interest is $70.96.

2. What is the difference between the exact interest and the common interest on $2000 from July 1 to November 1 at 6%?

Find the exact interest on:

3. $675 from July 10 to Sept. 10 at 7%.

4. $225 from Jan. 1 to Nov. 4 at 6%.

5. $1500 from March 6 to June 1 at 5%.

6. $360.30 from May 25 to Sept. 1 at 6%.

7. Find the amount of $340 at 7% exact interest from December 11, 1918 to August 27, 1919.

8. On May 11, 1920, $600 is loaned at 6%. Find the amount due Sept. 2, 1920, exact interest.

9. If $800 is loaned at 5% on May 28, 1919, when will it amount to $840?

17. *Complete and learn:*

1 × 19 = 19	95 ÷ 19 = 5	95 ÷ 5 = 19
2 × 19 = 38	76 ÷ 19 = 4	76 ÷ 4 = 19
to	to	to
5 × 19 = 95	19 ÷ 19 = 1	19 ÷ 1 = 19

18. *Written Problems.*

1. An article is listed at $150 but is bought at $33\frac{1}{3}\%$ and 10% off. For what should it be sold to gain 25%?

2. A man buys a house and lot for $6000. He pays $\frac{2}{3}$ of the amount in cash and the remainder after 1 year 4 months with 5% interest. Find the amount of the second payment. Banker's method.

3. The difference between 5 times a certain number and 9 times the same number is 28. Find the number. Algebra.

4. The American Medical Association found that as a result of the celebration of the Fourth of July in the United States there were:

Year	Dead	Injured
1903	466	3983
1909	215	5091
1916	4	80

How do you account for the marked decrease in casualties in 1916?

Make an original problem on the foregoing statistics.

5. One number is 2 times as large as another, and the difference between the two is 18. Find the numbers. Algebra.

6. Seventy-five pounds of bronze are to contain 45% of zinc, 9 lb. of tin and the remainder copper. How many pounds of copper are used? How many per cent?

7. If a yacht sails 24 miles in 90 minutes, how long will it take it to sail 144 miles?

8. Which is the better discount for the buyer, 40 and 10% off, or 30 and 20% off?

9. A cotton plantation contains 1350 acres. Allowing 250 lb. to the acre and 500 pounds to the bale, how many bales were produced on this plantation? At 42¢ a pound, how much did the planter receive for his cotton?

10. One pound of dehydrated potatoes equals $6\frac{1}{2}$ pounds of the fresh. How many pounds of the fresh potatoes would be required to make 60 pounds of dehydrated potatoes? Proportion.

11. Bordeaux mixture for spraying contains $2\frac{1}{2}\%$ of copper sulphate and unslaked lime in a solution of water. How many pounds of water in a barrel containing 160 pounds of the mixture?

12. The wealth of the United States is estimated at 150 billion dollars; that of England 85 billion dollars; and of France 50 billion. Rewrite this information, showing the ratio in percentage existing between the wealth of the United States and that of the other countries.

13. In spite of the fact that there is more wealth in the United States than in any other country the American people as a people do not have the habit of saving as they should. Statistics show that during 5 recent years an average of 27,011 adults died each year of that period. Of these 23,051 or ——% left no estate at all. This means that the surplus wealth is accumulated by less than ——% of the population.

14. Albert and Sam catch 30 fish. Albert catches 4 times as many fish as Sam. How many does each catch?

15. If 400 pounds of raw cotton are required for 100 pounds of finished clothing and the freight on clothing from Savannah to New York is $1.28 a hundred and on cotton 75¢ a hundred, how much freight per hundred pounds of clothing would New York save by having clothing made in Savannah instead of at home?

16. A pupil who attended school 81 days during a term was graded 90% in attendance. How many days was he absent?

17. By his opposition to a certain measure a councilman lost 406 of his supporters at the previous election, receiving only 3248 votes. What per cent of his votes did he lose?

19.* *Algebra — The Equation: continued.*

See previous lesson, p. 212.

An axiom is a truth which is so simple as to be self-evident. The following axioms are frequently used in the solution of equations:

If equal numbers be added to equal numbers, the sums will be equal.

$$x - 5 = 12$$
Adding 5 to each member, we have:
$$x = 12 + 5;$$
$$x = 17$$

If equal numbers be subtracted from equal numbers, the remainders will be equal.

$$x + 7 = 10$$
Subtracting 7 from each member, we have:
$$x = 10 - 7;$$
$$x = 3$$

After solving each of the following problems, state which of the axioms you used.

1. If William should add 7 marbles to what he now has, he would then have 22 marbles. How many marbles has he now?

2. A number diminished by 9 leaves 6. What is the number?

3. A certain number less 5 is 23. What is the number?

4. In $3x + 7 = 16$, what is the value of $3x$?

5. I paid $40 for a watch and chain. The watch cost $25. What was the cost of the chain?

6. Indianapolis, Zionsville and Lebanon lie on a straight road. It is 40 miles from Indianapolis to Lebanon and 16 miles from Indianapolis to Zionsville. How far is it from Zionsville to Lebanon?

Find the value of x:

7. $x + 3 = 14$	**11.** $x - 9 = 25$	**15.** $x + 11 = 29$
8. $x - 9 = 7$	**12.** $x + 8 = 27$	**16.** $x - 7 = 35$
9. $x + 5 = 15$	**13.** $x + 13 = 30$	**17.** $x + 15 = 27$
10. $x - 15 = 19$	**14.** $x - 26 = 15$	**18.** $x - 27 = 16$

*If equal numbers be mul-
tiplied by equal numbers, the
products are equal.*

$$\frac{x}{2} = 5$$

After multiplying each member by 2, we have:

$$x = 2 \times 5$$
$$x = 10$$

*If equal numbers be di-
vided by equal numbers, the
quotients are equal.*

$$2x = 16$$

After dividing each member by 2, we have:

$$x = 16 \div 2$$
$$x = 8$$

19. $\frac{1}{3}$ of my money is \$15. How much have I?

20. There are 18 cows in two fields. The number in one field is 5 times the number in the other. How many cows in each field?

21. The sum of two numbers is 18, and one is twice the other. Find the numbers.

22. The difference between two numbers is 18, and the greater is four times the lesser. Find the numbers.

23. A number is composed of two digits. The tens' digit is four times as great as the units' digit, and the sum of the digits is 10. Find the number.

24. I am thinking of a number. When it is multiplied by 3, and 5 is added to the result, the sum is 17. What is the number?

25. $\frac{3}{4}$ of the total height of a bridge pier is out of water and 15 feet of the height is under water. What is the height of the pier?

Find the value of x:

26. $\frac{x}{3} = 81$

27. $3x = 81$

28. $2x + 17 = 33$

29. $11x - 5 = 17$

30. $\frac{x}{2} + 5 = 25$

31. $5x - 10 = 15$

32. $14y - 1 = 11y + 5$

33. $3m + 2m = 4m + 19$

20. *Oral Problems.*

1. During the month, a pupil missed 10 words out of 160. What per cent did he spell correctly?

2. A hardware merchant sold 2 knives for $1 each. On one he lost 25% and on the other he gained 25%. Did he lose or gain on the transaction and how much?

3. How much does a man lose who idles away 90 work days each year when wages are $2.50 a day with board?

4. Four men can do $\frac{8}{9}$ of a piece of work in one day. What part of the work can one man do in one day? How long would it take him to do all the work?

5. A boy by selling newspapers at 5¢ each gained $66\frac{2}{3}\%$ of the cost to him. What had he paid for them?

6. In buying shoes at a commission of $2\frac{1}{2}\%$, an agent received $25. How much had he invested?

7. A can do a piece of work in 3 days which it takes B 4 days to perform. A earns $3 per day. How much does B earn per day?

8. One man spent $20 and another 20¢. What is the ratio of the amount the second man spent to the amount the first man spent?

9. One half of the money received by a newsboy is profit. What per cent does he make?

10. How much picture molding is needed to make a frame $5\frac{3}{8}$ inches long and $3\frac{1}{8}$ inches wide?

11. In 7 years Roy will be 15 years old. How old is he now? Algebra.

12. A boy who had learned to use tools earned $18.50 in one year doing repair work and making articles for the home. At that rate, how much could he earn in 5 years?

13. If it takes $1\frac{3}{8}$ yards of cloth to make a child's dress, how many yards will it take to make 8 such dresses?

21. *Find the value of x. At sight:*

1. *a.* $x + 4 = 16$ 　**2.** *a.* $5x = 30$ 　**3.** *a.* $\frac{x}{3} = 21$

　　b. $x - 4 = 16$ 　　　*b.* $x - 5 = 30$

　　c. $2x = 16$ 　　　　*c.* $x + 5 = 30$ 　　*b.* $x + 4 = 21$

　　d. $\frac{x}{2} = 16$ 　　　*d.* $\frac{x}{5} = 30$ 　　*c.* $3x = 21$

　　　　　　　　　　　　　　　　　d. $x - 5 = 21$

22.* *Two Short Methods for Multiplying:*

1. By 99.

a. For study. $99 \times 57 = ?$ 　　　*b.* 63 　　*e.* 78

　5700　　(100×57) 　　　　　*c.* 84 　　*f.* 38

　$\underline{-\ 57}$　　$(\ \ 1 \times 57)$ 　　　　　*d.* 46 　　*g.* 59

　5643

2. By 11.

a. For study. $11 \times 43 = ?$ 　　　*b.* 97 　　*e.* 78

　　43　　$(\ 1 \times 43)$ 　　　　　*c.* 85 　　*f.* 33

　$\underline{430}$　　(10×43) 　　　　　*d.* 69 　　*g.* 27

　473

23. *Simplify:*

1. $\dfrac{6\frac{3}{4} + (5\frac{1}{2} \times 3\frac{1}{2}) - 7\frac{1}{4}}{6\frac{2}{5} + 5 - 8\frac{1}{5}}$

2. $(.25 \times 3 \times .002) \div (.5 \times .01 \times .05)$

24. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
896	998	997	866	799	648
559	589	378	938	987	697
988	499	499	999	679	387
595	889	768	368	567	686
677	958	498	899	678	278
399	365	486	396	897	989
897	497	647	789	949	279
478	867	699	379	987	978
779	589	668	697	589	787
689	868	798	887	686	998

25.* *Bank Discount — Interest-bearing Note.*

Scene I: Mr. Blackford's Garage. Mr. A. C. Spencer buys an automobile of Mr. Martin Blackford. He pays $200 cash and gives his note (write one) for $900 due in 60 days at 5% interest.

Scene II: The First National Bank on the same day. Mr. Albert C. Kaylor, the note teller, discounts the note at 6% and gives Mr. Blackford the proceeds, which is $898.43.

Mr. Blackford should ask Mr. Kaylor to explain why banks charge discount (interest) upon the face of the note rather than upon the proceeds, which is the amount they really lend.

Scene III: At the bank 60 days later. Mr. Spencer pays $907.50 to Mr. Kaylor and receives from him the note which he originally gave to Mr. Blackford. It is stamped:

> Received Payment
> A. C. Kaylor   June 15, 1920.
> First National Bank

A bank note which can be legally transferred is called *negotiable paper.*

Discount on an interest-bearing note is calculated upon the amount due at maturity.

26. *Problems in Bank Discount.*

1. Find the proceeds on a note for $5400 due in 90 days at 6% interest if it is discounted at 5% on the day it is made.

2. A 120-day note for $5250 dated Sept. 15 was discounted October 15 at 6%. Find the proceeds.

3. Find the bank discount and the proceeds of a sixty-day note for $480 with interest at 5%, discounted ten days after it was made at 6%.

4. A note for $5700, dated May 12 and due in four months at 4% interest, was discounted May 18 at 5%. Find the proceeds.

5. For what sum must I draw my note for 60 days to obtain $2000 in cash if the rate of discount is 6%?

27.* *Fire Insurance — Questions for Investigation.*

1. How does fire insurance enable a man to carry a larger stock of goods than he otherwise could?

2. How can an insurance company afford to insure for a large sum and yet charge a premium of less than 2%?

3. Why does no insurance company underwrite a policy for the full value of the property?

4. Why does an insurance company always send notice to the property owner that his insurance will expire at noon on a certain day?

5. What should the owner of the property do when he receives this notice? Why?

6. Why does an insurance company sell its insurance at different rates? Name one kind of building that would be insured at a high rate. One at a low rate.

7. What is a fire hydrant? How is it used? How is a fire cistern used? How would proximity to these affect the rate of insurance?

8. Describe an automatic sprinkling system which you have found in use in some large business concerns. Name several classes of business that install these sprinklers. Would this affect their insurance rate?

9. Why is it that the people in some cities have higher rates of insurance than those in other cities on the same kinds of risks?

10. What is a salvage corps? By whom is it maintained?

11. What is the business of an insurance adjuster? Name several things on which he should be especially informed.

12. Why does the insurance company in the case of a small fire prefer to repair the damage themselves rather than pay the insurance in cash?

13. Insurance is usually stated as a certain amount on $100. What would be the rate on $100 at $1\frac{1}{2}$%?

14. Why do both the company and the insured prefer a policy extending over several years rather than for one year only?

15. Why is it that. companies carrying heavy insurance prefer to place that insurance with companies in different cities rather than to place it all with home companies? What experience have San Francisco and Baltimore had along this line?

28. *Fire at the Meyer Department Store. Dramatize.*

Scene I: The night watchman discovers a blaze on the fourth floor. He puts in the fire call and rushes for a fire-extinguisher. The fire company and the salvage corps respond, also the proprietors. The fire is put out.

Scene II: The next day. Insurance adjuster meets with proprietors to effect a settlement. Delay is caused by inquiry as to the origin of the fire and the amount of damage. Final settlement is made after the lapse of a week or ten days.

Scene III: A fire sale of damaged goods.

All problems in the dramatization should be so easy of solution that a pencil is not required. Encourage realistic touches by the pupils that will add to a full understanding of this frequent misfortune in business and the part insurance plays in it.

29. *Problems on Fire Insurance.*

1. Mr. Henley has property worth $6000. He insures it for $\frac{4}{5}$ of its value. (*a*) What is the face of the policy? (*b*) What is the annual premium at 20 cents per $100? (*c*) What must he pay to insure it for 3 years, the rate being twice that for 1 year's insurance?

2. How much is saved in insurance on $4000 in 12 years by taking out 4 three-year policies at $.40 on $100 rather than 12 one-year policies at the rate of $.20 a hundred? .

3. How much insurance does a man receive for $25 when the rate is $\frac{1}{2}$%?

4. I paid $54 for an insurance policy on my factory. If the rate is $\frac{3}{4}$%, for how much is my property insured?

30. *Written Problems.*

1. The New York Milk Committee, which supplies pure milk to infants, in a recent report stated that 900,000 infants had been born in New York City in 7 years. If the annual death rate for the 7 previous years had prevailed, there would have been 150,000 infant deaths instead of the 100,000 which actually occurred. By what (per cent) had the committee reduced the death rate in 7 years?

2. The milk from a herd of 50 Jersey cows, sold at 8¢ a quart, amounted in one summer to $4050. How many quarts were sold? What was the average quantity for each cow?

3. The crop of buckwheat from an acre is an average of 25 bushels. If 25% is destroyed by frost, how many bushels may be expected from 125 acres?

4. The United States government in shipping 26,000,000 pound-cans of fresh vegetables to the army in France paid the transportation charges and the cost of labor on 19,500,-000 pounds of water, which is the larger part of all vegetables. If these vegetables had been dehydrated before sending, what per cent of this cost would the government have saved?

5. What will it cost to fence a two-acre field, whose length is 20 rods, at $1.25 a rod?

6. A schoolroom is 32 feet × 28 feet × 15 feet and seats 48 pupils. Each pupil needs 225 cubic feet of air-space. Is this room of adequate size?

7. A boy earns $\frac{1}{2}$ as much as his older brother. The two together earn $21 a week. How much does each earn?

8. A man left his widow $7500. This was $3\frac{3}{4}$ times what he left his daughter. How much did he leave to both?

9. A coal dealer buys coal at $4 a ton of 2240 pounds and sells it at $5 a ton of 2000 pounds. What is his per cent of profit?

10. If two trains 105 miles apart are running toward each other, one at the rate of 50¾ miles an hour, and the other at the rate of 20⅘ miles an hour, how far apart will they be in half an hour?

11. Seven times my money less $5 equals $37. How much money have I?

12. By what must ¾ be multiplied to produce 3¾?

13. From a piece of cloth measuring 11¼ yards there have been sold 4¾ yards. If the remainder is worth $26, what was the value of the whole piece?

14. How much tax must a man pay on property assessed at $5500 at the rate of $.021 on the dollar?

15. What are the proceeds of a 60-day note for $720 with interest at 5% when discounted at 6%, 1 month after date?

16. What do I save on a 5-year fire insurance policy for $2000 if the yearly rate is $.32 on the hundred dollars and $1.28 on $100 for the 5-year policy?

17. An auctioneer sold the following articles at a farmer's sale. What is his commission at 2%?

> 1 cow at $84
> 2 wagons, one for $38; the other for $53
> 20 tons of hay at $36
> 1 harrow at $4.90.

18. At the sale mentioned above, a discount of 5% was allowed for cash. What amount in cash would the man pay who bought the better wagon, the hay and the harrow?

19. A passenger train runs from Chicago to Southport in 5 hr. 40 min. A freight train runs the same distance in 9 hr. 20 min. How much longer does it take the freight train?

31.* *Gross and Net Profits.*

> The total profit on a sale is called the *gross profit.* The amount left after the expenses of the sale are taken out is called the *net profit.*

1. *For study.* The Baylor Hardware Company bought an icebox for $45 and sold it at an advance of $33\frac{1}{3}\%$. If $\frac{1}{3}$ of the profit was the cost of the sale, what was the net profit?

Method A	Method B
$33\frac{1}{3}\%$ of $45 = $15 (or g. p.)	$\frac{2}{3}$ of $33\frac{1}{3}\%$ (or g. p.) $= 22\frac{2}{9}\%$ (or n. p.)
$\frac{1}{3}$ of $15 = $5 cost of sale.	$22\frac{2}{9}\%$ of $45 = $10 (or n. p.)
$15 − $5 = $10 (or n. p.)	

The net profit was $10.

2. A dealer in china and glassware bought 3 dozen plates for $9. He sold them at an advance of 40%. The cost of the sale he estimated at $\frac{3}{4}$ of the profit. What was his net profit? Two methods.

3. A fruit dealer bought peaches at $3 a bushel and sold them for $4.20. His expense of sale was 4%. What was his net profit?

4. Mr. Walton bought 75 barrels of potatoes at $4.50 a barrel. He estimated that the cost of selling the potatoes would be 5% more. He also paid $37.50 for freight. At what price per barrel was it necessary for him to sell the potatoes to make a net profit of $16\frac{2}{3}\%$?

5. A man rented a house valued at $9000 for $75 a month. His insurance and repairs came to 4% of the value of the house. What were his net profits for one year?

6. A dairyman shipped 1500 pounds of butter to a commission merchant, who sold it at 50¢ per pound. If the cost of shipping was $12.50 and the cartage amounted to $4, how much did the shipment net the dairyman after paying a commission of 4%?

32. *Written Dictation.*

1. Write in Roman numerals: 1920.

2. 42 is what per cent of 14?

3. How many quarter-inch squares are there in a 3-inch square?

4. I sold goods for $85, thereby gaining $5. What was the per cent of gain?

5. When $a = 3$ and $b = 4$, what is the value of ab?

33.* *Case II — Fractional Relations.*

1. *For study.*

$\frac{2}{3}$ is $\frac{3}{4}$ of what number? (Equivalent to $\frac{2}{3}$ (of 1) is $\frac{3}{4}$ of what (other) number?)

Analysis	Short Method
$\frac{3}{4}$ of the number = $\frac{2}{3}$ (of 1)	$\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$
$\frac{1}{4}$ of the number = $\frac{2}{9}$ (of 1)	If given $\frac{3}{4}$ of a whole, the whole
$\frac{4}{4}$ or the number = $\frac{8}{9}$ (of 1)	is $\frac{4}{3}$ of the part given. Prove by integers.

$\frac{2}{3}$ is $\frac{3}{4}$ of $\frac{8}{9}$

2. $\frac{4}{5}$ is $\frac{5}{6}$ of what number?   **5.** $\frac{3}{5}$ is $\frac{4}{7}$ of what number?

3. $\frac{2}{3}$ is $\frac{5}{6}$ of what number?   **6.** $\frac{3}{4}$ is $\frac{5}{11}$ of what number?

4. $\frac{2}{3}$ is $\frac{5}{9}$ of what number?   **7.** $\frac{3}{7}$ is $\frac{5}{12}$ of what number?

34. *At sight:*

1. If $37\frac{1}{2}\%$ equals 21 pounds, 25% will equal —— pounds.

2. If 75% equals 30 bushels, 80% will equal —— bushels.

3. If $16\frac{2}{3}\%$ equals 2 quarts, $116\frac{2}{3}\%$ will equal —— quarts.

4. If $2\frac{1}{2}\%$ equals 5 yards, 100% will equal —— yards.

5. If $66\frac{2}{3}\%$ equals 80 books, $16\frac{2}{3}\%$ will equal —— books.

6. If $8\frac{1}{3}\%$ equals 4 weeks, 75% will equal —— weeks.

7. If $3\frac{1}{3}\%$ equals 9 barrels, 100% will equal —— barrels.

35. *Solve by short method:*

1. $2040 \times .125 = ?$ **4.** $640 \times .375 = ?$ **7.** $400 \times .625 = ?$

2. $860 \times .75 = ?$ **5.** $120 \times .66\frac{2}{3} = ?$ **8.** $720 \times .875 = ?$

3. $755 \times .40 = ?$ **6.** $786 \times .50 = ?$ **9.** $960 \times .08\frac{1}{3} = ?$

36. *Written Problems.*

1. These graphs represent the standing of a class after
solving 5 problems with averages as follows:

<table>
<tr><td>1st.: 100%</td></tr>
<tr><td>2nd.: 90%</td></tr>
<tr><td>3rd.: 84%</td></tr>
<tr><td>4th.: 72%</td></tr>
<tr><td>5th.: 100%</td></tr>
</table>
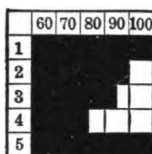
BLOCK GRAPH   LINE GRAPH

In similar manner chart the standing of another day's
lesson when the per cents for the 5 problems were respec-
tively, 96; 85; 100; 47; 83. What should the pupils in
this class learn from these graphs?

2. Make out a bill of sale with a discount of 15% to
Wm. J. Royce for the following articles: 1 bunch bananas at
$5.75; 2 boxes oranges, California navels, at $4.50; 1 box
Messina lemons at $3.25; 2 dozen cocoanuts at $1.25,
3 dozen Florida pineapples at $1.80. Sign and receipt the
bill.

3. There are 6000 books on the shelves of the children's
room in our library. On an average 120 are drawn out
each school day and on Saturday 150. In two weeks' time
what per cent of the books have been taken out?

4. Mr. Blodgett paid in 1918: poll tax, $2; tax on
personal property, $27; tax on real estate, $141. Find
total amount to be paid.

5. *a.* Add $17\frac{3}{4}$ hundredths, $65\frac{1}{8}$ thousandths, $5\frac{1}{20}$ tenths.
b. What per cent of 50 is 3?

6. Fire destroyed a third of my stock of groceries. I sold
50% of the remainder for $270, which was 10% less than
cost. At that rate what was the value of the entire stock?

7. What is the value of a rectangular field 40 rods wide
and 108 rods long at $62 an acre?

8. If $1\frac{2}{3}$ inches are cut from each end of a yard stick what is the length of the piece remaining?

9. What income is realized on $5000 invested in a house and lot which rents for $35 a month and out of which is paid annually $70 for taxes, $10 for insurance and $40 for repairs?

10. In a sixth-grade class of 48 pupils, $\frac{5}{8}$ joined the Junior Red Cross the first day. On the second day, 6 more pupils joined. What part of the class had not yet joined? Show by diagram.

11. Henry earned $2 for Saturday work and 50 cents for running errands. He sold 3 used school books at 25 cents each and received $2.25 interest on money he had loaned. For an electric lamp which he wished to make, he bought quartered oak for $2.25, wire for 65 cents, 3 sockets at 30 cents each, art glass for 60 cents, stain and finish for 45 cents. Make out an account showing these transactions and the balance, if any.

12. Mr. Brown receives a salary of $2400 a year. He spends $\frac{1}{12}$ of it for clothing, $\frac{1}{5}$ for house rent, $\frac{12}{25}$ for other expenses. He invests the remainder in a building association. How much does he invest? Solve without pencil as far as possible.

13. A farmer delivered at a grocery, 50 lb. of butter in 2-pound rolls at $1.20 per roll. He was given in exchange 50 lb. of sugar at 20¢ per pound. He received the difference in cash, with which he bought gasoline for his auto at 25¢ a gallon. How many gallons did he buy?

14. Miss Mayo bought a dwelling for $4500. In order to convert it into a double house, she expended $\frac{2}{3}$ of the original cost. After improving the property she was able to sell it for $7000. How much did she gain?

15. What time is it when $\frac{3}{4}$ of the day of 24 hours has gone?

16. In payment of a debt of $30, a man received a $20 bill, 7 silver dollars and the rest in equal numbers of half-dollars and quarters. How many half-dollars did he get?

37. *Fire Prevention: From the Annual Report of the Fire Marshal of the State of Indiana for the Year 1919.*

1. From May 1 to December 31 there was a loss of $5,932,110 caused by 6209 fires. 65% of these fires were clearly preventable and had they been prevented the people of the state would have been saved $——.

2. The chart below shows the distribution for each hour of the day for 277 fires caused by sparks from the chimney alighting on the shingle roof. These fires were due to combustible roofing and defective flues. During what hours were there the greatest number of fires? When were there practically none?
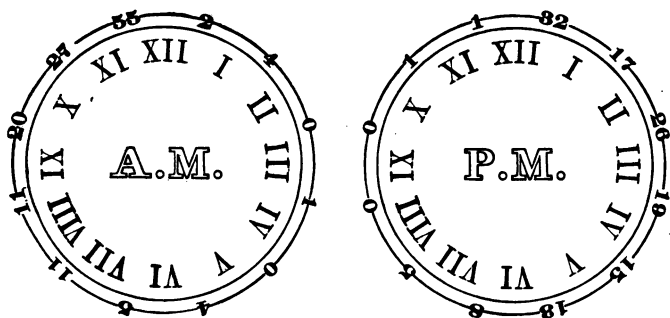
3. There has been much discussion of the value of the lightning rod. Thomas A. Edison indorses the lightning rod in unqualified terms. In the year 1913 the lightning losses totaled 1006, causing a property damage of $864,221. Of this number 1.5% of the buildings were rodded; 78.3% were not rodded and no information was given concerning 20.2%. From these statistics, what is your conclusion?

4. 360 fires and a loss of $28,000 were due directly to the careless handling of matches. 152 of these fires or ——% were caused by children playing with matches. Make a problem that will help to prevent this.

38. *Oral Problems.*

    1. Express $12\frac{1}{2}$% of one gallon in lower denominations.

    2. 3 cubic feet are what per cent of a 2-foot cube?

    3. If 48 pounds of tea cost $20, what will 12 pounds cost?

    4. $6 is $\frac{3}{4}$% of what number?

    5. $2 is what per cent of $800?

    6. What decimal of a peck is 7 quarts?

    7. Find the surface of a 10-inch cube.

    8. What is the cost of half a gross at 8 for a dime?

    9. An arc of 60 degrees is what part of a circle?

    10. What principal will produce $12 in 3 years at 4%?

    11. Bought 3 for 4¢ and sold at the rate of 2 for 3¢. Did I gain or lose and what per cent?

    12. What is the cost of 49 pounds of flour at $8 per barrel?

    13. The product of the means equals 150; one ratio is $15 : 25$. Give the proportion.

    14. How many acres in a farm $\frac{1}{4}$ of a mile square?

    15. If a floor 18 feet by 9 feet requires 24 yards of carpeting, how wide must the carpeting be?

    16. The tax is $48 and the tax rate is $.012. What is the assessed value?

    17. Selling at $3.50, I lost $12\frac{1}{2}$%. What per cent should I have gained by selling at $5?

    18. A house worth $2500 was insured for $\frac{4}{5}$ of its value. The premium was $50. What was the rate of premium?

    19. A's age is $\frac{2}{3}$ of B's age. B's age is what per cent of A's age?

    20. Find the cost of an insurance policy for $1500 at $1\frac{1}{2}$% premium.

39.* *Life Insurance — A Lesson in Salesmanship.*

Time 8:00 P.M. *Mr.· Saunders lays down the evening paper which he is reading and goes to the door when the bell rings.*

Mr. Saunders (opening the door): Good evening, sir.

Mr. Lewis (presenting his business card):

> ### RALPH LEWIS
> 37 WALNUT STREET
> PHILADELPHIA
> *Representing*
> STATE LIFE INSURANCE COMPANY
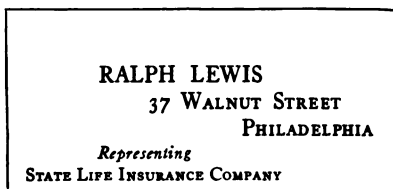
Good evening, Mr. Saunders. Lewis is my name. I represent the State Life Insurance Company. I have called this evening to see if I can interest you in taking out a policy.

Mr. Saunders: Glad to know you, Mr. Lewis. (*The men shake hands.*) Come in. Let me take your umbrella. I think you will find this a comfortable chair.

Mr. Lewis (seating himself): Thank you. This rain is a godsend to the crops.

Mr. Saunders: Indeed it is. In fact you would not have found me at home to-night except that the downpour this afternoon made it impossible for me to drive over to Seymour as I had planned.

Mr. Lewis: Your misfortune is my good fortune. I hope you have begun thinking about insurance. While a man is young he should take advantage of the low premiums.

Mr. Saunders: Yes. I have been considering the matter for several weeks and have made inquiries about several companies. I hear the State Life most highly spoken of. Do you advise an endowment or an ordinary life policy?

Mr. Lewis: I advise an endowment policy by all means. Suppose you should buy a $1000 endowment policy. At the end of 20 years we will pay you $1000 in cash. What is your age, Mr. Saunders? I take it you are unmarried.

Mr. Saunders: I am 25 years of age and unmarried.

Mr. Lewis (opening his sales book): Your annual premium will be $41.10. At the end of 20 years you will have paid in $—— and we return to you $1000. This represents $178 more than you have paid in.

Mr. Saunders: Why do you advise me to take the endowment policy rather than the ordinary life?

Mr. Lewis: You understand that both policies are insurance. Should you die, the amount of the policy will be paid to your beneficiary in either case. Now I advise the endowment policy for you because it gives not only insurance but a savings account. If you obligate yourself to save money under contract it will be saved. Should you try a savings account in the ordinary way, you would in all probability never keep it up. It is so easy to spend one's money.

Mr. Saunders: How much would the ordinary life cost me for 20 years?

Mr. Lewis: We never speak of any number of years in the ordinary life policy. The holder is just expected to pay year by year until he dies. At the end of 20 years, however, you would have paid in $310. If at the end of that time you discontinue the policy you cannot even collect as much

as you have paid in. The cash surrender value is $213, a loss of $——.

Mr. Saunders: 1 understand then that though I have insurance to the amount of $1000, in either case with the ordinary life policy at the end of 20 years I should lose $97 and with the endowment policy I should receive all I had paid in and a bonus of $178.

Mr. Lewis: That is correct. I hope you will let me write up an endowment policy for you.

Mr. Saunders: Very well, you may. When shall I present myself for medical examination?

Mr. Lewis: I will make an engagement with Dr. Wales, our medical examiner, for you to-morrow. What hour would suit you best?

Mr. Saunders: Any time after 3 o'clock. By the way, now that you are here, how would you like to talk insurance to a friend of mine who lives in the next apartment?

Mr. Lewis: I certainly should like to talk to him. Thank you very much.

(*Mr. Saunders leaves the room and presently returns with Mr. Gwinn.*)

Mr. Saunders: Mr. Gwinn, may I introduce Mr. Lewis, who represents the State Life Insurance Company. (*The men shake hands.*)

Mr. Gwinn: I am glad to meet you, Mr. Lewis.

Mr. Lewis: Glad to meet you, Mr. Gwinn.

Mr. Gwinn: Mr. Saunders and I have been trying to find out the relative merits of the ordinary life, the endowment, and the limited-payment life policies.

Mr. Lewis: All insurance companies carry these three kinds of policies to accommodate people differently situated.

Mr. Gwinn: We had come to that conclusion. I have recently married and my expenses, consequently, are greater than those of Mr. Saunders. I have concluded that I cannot afford an endowment policy.

Mr. Lewis: I agree with you. You should take out a

20-payment life. If you will give me your age I can tell you in a moment what the figures are.

Mr. Gwinn: I am 25 years of age.

Mr. Lewis: Your annual premiums will be $25.35 and at the end of 20 years you will have a paid-up policy for $1000. If at the end of your payments you wish to surrender your policy, its cash value will be $456.

Mr. Gwinn: That sounds good. I will talk the matter over with Mrs. Gwinn. I am glad to have met you. With the help you have given I shall come to a more intelligent conclusion.

Mr. Lewis (both men rising): I am glad to have met you, Mr. Gwinn. Would you like to have a copy of the policy to look over? (*Hands him a copy.*)

Mr. Gwinn: I should very much. Thank you. Good night.

Mr. Lewis (taking his hat and umbrella): I will say good night to you, Mr. Saunders. I will telephone you in the morning at what hour Dr. Wales can examine you.

Before attempting this lesson, pupils should obtain copies of policies and acquaint themselves with the general nature of the insurance business by questions at home and visits to insurance offices. Further complications such as "participating" and "non-participating" policies are inadvisable.

40. *Written Dictation.*

1. $2.5 \times .5 = ?$

2. $1.2 \div 4 = ?$

3. $3\frac{1}{4} - 1\frac{3}{8} = ?$

4. Cost of $2\frac{1}{2}$ doz. when $\frac{1}{4}$ doz. costs 10¢.

5. Sale price when discount offered is 15% on $200.

41. *Solve by short method:*

1. $350 \div 87\frac{1}{2} = ?$ **5.** $875 \div 83\frac{1}{3} = ?$ **9.** $320 \div 62\frac{1}{2} = ?$
2. $240 \div 33\frac{1}{3} = ?$ **6.** $120 \div 16\frac{2}{3} = ?$ **10.** $990 \div 75 = ?$
3. $12 \div 6\frac{1}{4} = ?$ **7.** $8 \div 12\frac{1}{2} = ?$ **11.** $16 \div 25 = ?$
4. $183 \div 37\frac{1}{2} = ?$ **8.** $224 \div 40 = ?$ **12.** $368 \div 80 = ?$

42. *At sight:*

1. $18 : 27 = ? : 15$ **6.** $25 : 12\frac{1}{2} = 12 : ?$
2. $37\frac{1}{2} : 25 = ? : 8$ **7.** $? : 50 = 8 : 32$
3. $6 : 42 = 12\frac{1}{2} : ?$ **8.** $37\frac{1}{2} : ? = 75 : 100$
4. $? : 74 = 14 : 28$ **9.** $8\frac{1}{3} : ? = 9 : 18$
5. $9 : ? = 63 : 21$ **10.** $? : 83\frac{1}{3} = 15 : 75$

43.* *Case III — Fractional Relations.*

1. *For study.* $\frac{3}{5}$ is what per cent of $\frac{8}{9}$?

Analysis	Short Method
$\frac{8}{9} = 100\%$ of itself	$\frac{3}{5} \div \frac{8}{9} = \frac{3}{5} \times \frac{9}{8} = \frac{27}{40}$
$1 = 112.5\%$ of $\frac{8}{9}$	$\frac{27}{40} = 67.5\%$
$\frac{3}{5} = \frac{3}{5} \times 112.5\% = 67.5\%$	

See page 44.

2. $\frac{2}{5}$ is what per cent of $\frac{5}{6}$? **5.** $\frac{3}{5}$ is what per cent of $\frac{8}{12}$?
3. $\frac{1}{2}$ is what per cent of $\frac{3}{4}$? **6.** $\frac{3}{4}$ is what per cent of $\frac{1}{2}$?
4. $\frac{1}{5}$ is what per cent of $\frac{2}{5}$? **7.** $\frac{7}{8}$ is what per cent of $\frac{1}{4}$?

44. *Find the value of x:*

1. $\frac{x}{3} = 21$ **5.** $4x = 124$ **9.** $8x - 4 = 28$
2. $12x = 36$ **6.** $\frac{2x}{5} = 16$ **10.** $\frac{3x}{4} = 3$
3. $3x + 4 = 25$ **7.** $2x - 4 = 1$ **11.** $4 + 3x = 34$
4. $8x - 2 = 14$ **8.** $5x + 3 = 18$ **12.** $3x - 6 = 18$

45. *Find the quotient:*

1. $215{,}372.6 \div .269$ **4.** $24{,}029.49 \div 2.97$
2. $27{,}948.41 \div 2.89$ **5.** $2{,}857.715 \div 37.8$
3. $18{,}714.93 \div 4.79$ **6.** $1{,}720{,}367 \div 283$

46. *Personal Insurance — Questions for Investigation.*

1. Why is it wise for a man or a woman to carry life insurance?

2. How can an insurance company afford to take the risk of paying out $1000 at the death of the policy holder in return for a small annual premium?

3. What is meant by expectation of life?

4. Why does the rate of premium increase with age in all kinds of policies?

5. Why should one investigate the financial standing of an insurance company before taking out a policy in that company?

6. On the ordinary life policy, premiums are paid during life. On a limited life policy, premiums are paid only for a specified number of years. In either case the policy is paid at death. The insurance company necessarily charges a higher premium on which kind of these policies?

7. Why is the premium for an endowment policy higher than for an ordinary life policy?

8. Why is the premium for a 20-year endowment higher than for a 20-payment life?

BRIEF TABLE OF ANNUAL PREMIUMS FOR
INSURANCE OF $1000

Age	Ordinary Life	20-Payment Life	20-Year Endowment
20	$14.02	$21.35	$40.85
25	15.70	23.21	41.10
30	17.88	25.45	41.49
35	20.91	28.50	42.33
40	24.91	32.29	43.65
45	30.48	37.17	46.10
50	38.14	43.88	50.18

47. *Problems in Life Insurance.*

1. Mr. Adams took out an ordinary life policy for $2000. He was 25 years old and lived 20 years. How much more or less than the face of the policy did he pay in premiums?

2. Mr. Roberts took out an ordinary life policy for $5000. He was 35 years of age when he took out the policy and died after making 5 payments. How much more did his beneficiary receive than the total premiums?

3. A traveling man 30 years old takes out an ordinary life policy of $4500. If he is killed in a railroad wreck 2 years later, how much does the company lose?

4. A man of 20 takes out an ordinary life policy for $3000. He dies at the age of 65. What is the difference between the premiums paid and the insurance?

5. At the age of 40 Mr. Layman took out a 20-year endowment policy for $3000. How much less would it have cost him for the term, if he had taken it out at the age of 20?

6. Mr. Hunt, who is 25 years of age, is considering a 20-payment life policy for $3000 and a 20-year endowment policy for the same amount. Imagine yourself Mr. Hunt and come to a decision, giving your reasons.

7. Miss Jameson at the age of 25 takes out a 20-year endowment policy for $2000. How much does the amount paid by the company at the end of the time exceed what she has paid in?

8. What is the difference in the annual cost of a 20-year endowment policy for $6000 taken out at the age of 25 and a 20-payment life policy for the same sum, taken out at the same age?

9. At the age of 30 a man took out a $2500 ordinary life policy and at the age of 35 a $1500 20-year endowment policy. How much does the insurance exceed the premiums paid if he dies at the age of 40?

48. *Written Problems.*

1. Through the planting of 47,337,000 acres in winter wheat in 1917, the production was estimated at one billion bushels or an average of —— bushels to the acre.

2. Soap that a druggist bought at $1.20 a dozen cakes was so damaged that he had to sell it for 8¢ a cake. What was his per cent of loss? What was his loss on 165 dozen?

3. George Stevenson has a herd of 24 dairy cows each of which averages 22 pounds of milk per day. The milk tests 3.8% butter fat which is worth 48¢ per pound. What is the daily income from the herd?

4. How many times will a roller 13.6 feet in circumference turn in rolling across a street that is 74.8 feet wide?

5. At $10.50 a cubic yard, what will it cost to dig a cellar 42 feet long, 12 feet 6 inches wide, and 8 feet deep?

6. $5 added to my money will give me $31. How much have I? Algebra.

7. Compare a floor 10 feet square with one 12 feet square. If it costs $20 to put tile on the smaller room, what will it cost to put tile on the larger one at the same rate?

8. The price of gas is 12¢ per hundred cubic feet, with a discount of 10% if paid within 5 days of the end of the month. My meter reading at the end of June was 67,300 cubic feet. The May reading was 64,800 cubic feet. I paid my June bill July 2. What sum did I pay?

9. Mr. Adams owned a $7000 piece of property which he rented at $70 a month. His gross income was what per cent of the value of the property? He paid for taxes $112.98, for insurance $24, for repairs $100. His net income was what per cent of the value of his property?

10. A watch and chain cost together $120. The cost of the watch was 3 times that of the chain. Find the cost of each. Algebra.

11. Find the prime factors of each of the following numbers: 42, 48, 126, 144. Indicate the combination of factors necessary to produce (a) the greatest common divisor of these numbers, (b) their least common multiple.

12. Make a receipted bill of the following: Arthur Kinneman buys this day, of Flagg Brothers, 2 bbl. of flour at $12; 20 lb. sugar at $.07; 4 lb. coffee at 45 cents; 5 lb. butter at 58 cents; 2 bu. potatoes at $2.25.

13. Every person breathes on an average 28 cubic feet of air per hour. In a room 32 feet × 28 feet × 15 feet how many hours will the air last 40 children, if unchanged by ventilation?

14. Find the number of square yards in the four walls and ceiling of a room $16\frac{1}{2}$ feet long, $13\frac{1}{2}$ feet wide, and 9 feet high, making no allowance for openings.

15. Simplify $\dfrac{1.75 + .5 + 10.75 + .33\frac{1}{3} \times 21}{(.25 + 2.00 + 1.75) \times 10}$ and express the result both as a common fraction and as a decimal fraction.

16. Four times my money and $40 more is 9 times my money. How much have I? Algebra.

17. A man walks $8\frac{3}{4}$ mi. in 2 hr. 20 min. How long will it take him to walk $11\frac{1}{8}$ miles? Solve by analysis and by proportion.

18. A merchant sold goods amounting to $1225; half of the goods he sold at an advance of 25% on the cost, the rest at an advance of $12\frac{1}{2}$%. How much did he pay for the goods?

19. What is the interest on $825 from May 16, 1920, to Feb. 21, 1921, at $5\frac{1}{2}$%?

20.† In estimating the cost of painting a building, the contractor estimates that 1 gallon of paint will cover 250 square feet and that the labor will cost twice as much as the material. What shall a contractor ask for painting a house two coats, the perimeter being 200 feet and the average height 20 feet, if paint costs him $3.60 per gallon and he wishes to make 20% profit on material and labor?

† See Table of Contents.

49. *Building a Home: I — Contract and Mortgage.*

Scene I: Office of W. A. Edson and Company — Architects.

Mr. Edson: Good morning, Mr. Layman. Here is a sketch of the house as I had thought of it. Does it meet your idea?

Mr. Layman: I am very much pleased with it and I think Mrs. Layman will be too. Can you keep within the $5000 limit?

Mr. Edson: I am sure it can be built for approximately that amount. The draftsman should finish the plans and specifications for you by the end of the week if this sketch is satisfactory. At that time I can give you the name of several contractors who will estimate the cost of the building. You will find them all honest men.

Mr. Layman: The contractor's fee is 10%, I believe, and yours is 6% for the plans and 4% additional for supervision.

Mr. Edson: That is correct except that the contractor adds 10% to his estimate of the cost of the building and the architect's fee is upon the estimated cost of $5000.

Mr. Layman: Mrs. Layman and I will go over the matter this evening and in the morning I will bring down our final suggestions. Thank you very much.

Mr. and Mrs. Layman have a clear title to the lot (owe nothing) upon which their house is to be built. They have made arrangements to become members of the People's Building and Loan Association in order that they may borrow money with which to build their home by giving a mortgage upon the property. The Association lends the money on a stipulated agreement that it shall receive a monthly payment of 1 % of the amount borrowed. From this amount interest at 6 % is to be deducted semiannually and the remainder applied toward the payment of the debt.

Scene II: Office of R. H. Russell, attorney for the People's Building and Loan Association.

Mr. Russell (shaking hands with Mr. and Mrs. Layman and Mr. Hedrick, contractor): Good morning. Will you be seated? I have drawn up the contract which our Association requires. *(Reads aloud.)*

This contract entered into this 10th day of April, 1920, by and between William C. Hedrick, as party of the first part, and Henry L. Layman and wife, as parties of the second part, witnesseth:

That the party of the first part, as contractor, agrees to build for the said Henry L. Layman and wife a house according to plans and specifications prepared by W. A. Edson and Co., Architects, on the property of said Henry L. Layman and wife in Davenport described as lot 7 in Osborne Subdivision, which plans and specifications are by reference made a part of this contract. The party of the first part agrees to furnish all the materials and to do all the work necessary to complete said house according to said plans and specifications in a first-class and workman-like manner and to have said house completed and ready for occupancy by the first day of August, 1920.

In consideration of the above the said Henry L. Layman and wife agree to pay the party of the first part the sum of five thousand six hundred dollars ($5600) as the full consideration and contract price for said house. Payment in full shall be made within ten (10) days after said house is ready for occupancy; provided, however, that said party shall first submit to Henry L. Layman and wife satisfactory evidence that all bills for labor and material entering into the construction of said house have been paid and that there are no outstanding claims and liens against the same.

It is understood that the said Henry L. Layman and wife have executed a mortgage to the People's Building and Loan Association in the sum of five thousand six hundred dollars ($5600), the proceeds of which mortgage are to be used in paying for said house.

Executed in duplicate this 10th day of April, 1920.

Mr. and Mrs. Layman and Mr. Hedrick together with two witnesses then sign the contract. This being done they give their note for $5600 and sign an agreement known as a mortgage. Should the Laymans fail to pay their note, the Building Association has the right to foreclose this mortgage, in which proceeding the court will order the property sold to pay the debt. In case of such sale the Laymans would have one year from date of foreclosure in which to redeem their property. They could do this by paying the amount of the debt, interest and court costs. Should they fail to do so, the court would sell the property for that amount and pay the debt. The Laymans would have lost their property.

50.* *The Powers of Numbers — Preliminary to Square Root.*

> The power of a number is the product arising from using that number a certain number of times as a factor. For example, 16 is the second power of 4 (4^2) and the fourth power of 2 (2^4).

1. 1^2 1^3
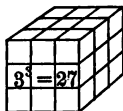
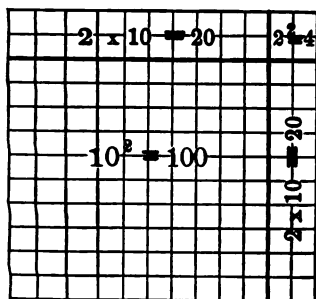2. $2^2 = 4$ $2^3 = 8$

3. $3^2 = 9$ $3^3 = 27$

1. What is the area of a 4-in. square? 5-in. square? x-in. square?

2. What are the cubical contents of a 4-in. cube? 5-in. cube? x-in. cube?

3. What is the size of a square whose area is 64 square inches? Whose area is x^2? Of a cube whose volume is 27 cubic inches? Whose volume is x^3?

51.* *To Find the Square of a Number of Two Orders.*

1. *For study.* $12^2 = (12 \times 12) = ?$

Solution

$$12^2 = (10 + 2)^2$$
$$(10 + 2)^2 = 10^2 + (2 \times 10 \times 2) + 2^2$$
$$12^2 = 100 + 40 + 4$$
$$12^2 = 144$$

2. Make a drawing to illustrate the square of any one of the following: 16; 26; 28; 25.

Make sure that the class grasps this principle preparatory to the extraction of square root on page 245.

52. *What is:*

1. $2\frac{2}{3}\%$ of 564?	**5.** $9\frac{1}{2}\%$ of 724?	**9.** $6\frac{1}{3}\%$ of 786?
2. $3\frac{1}{4}\%$ of 788?	**6.** $2\frac{3}{4}\%$ of 968?	**10.** $1\frac{3}{7}\%$ of 336?
3. $4\frac{3}{4}\%$ of 540?	**7.** $1\frac{5}{8}\%$ of 726?	**11.** $2\frac{4}{5}\%$ of 365?
4. $7\frac{1}{3}\%$ of 426?	**8.** $2\frac{7}{8}\%$ of 824?	**12.** $5\frac{1}{9}\%$ of 927?

53. *Add:*

1. 417	**2.** 581	**3.** 245	**4.** 479	**5.** 293	**6.** 832
652	629	349	463	277	478
765	924	938	779	487	923
739	786	705	678	386	873
984	937	477	482	682	689
859	724	841	962	573	798
487	692	238	389	775	991
298	496	467	917	238	346
843	739	394	998	839	819
468	496	298	843	466	433

54.* *Three Types of Partnership Problems.*

1. *For study.* A and B bought a wholesale grocery for which they paid $14,000. A furnished $8000 and B the remainder. The business netted $1120 at the end of the first year. What was each man's share?

<p align="center">Solution by Proportion</p>

<p align="center">$14,000 : $8000 = $1120 : A's share.</p>
<p align="center">$14,000 : $6000 = $1120 : B's share.</p>

2. *For study.* Uncle Jack had 21 marbles in his bag. He gave Walter, the older, 4 marbles every time he gave Edward 3. How many marbles did each one receive?

<p align="center">Solution by Proportion</p>

<p align="center">4 : 7 = ? : 21   Walter</p>
<p align="center">3 : 7 = ? : 21   Edward</p>

3. *For study.* If A can do a piece of work in 2 days and B can do it in 3 days, how long would it take them working together?

<p align="center">Solution by Analysis</p>

A can do $\frac{1}{2}$ of the work in 1 day.

B can do $\frac{1}{3}$ of the work in 1 day.

Together they can do $\frac{5}{6}$ of the work in 1 day.

$\frac{6}{6}$ or all the work ÷ $\frac{5}{6}$ of the work = $1\frac{1}{5}$ times.

It will take them $1\frac{1}{5}$ days working together to do the work.

4. A bankrupt surrenders property worth $5500 for the benefit of two creditors to whom he owes $8000 and $3000 respectively. How much should each creditor receive?

5. Mr. Sanderson and Mr. Lee own a drug store valued at $5400 in the ratio of 4 to 5. What is the value of each man's share?

6. Mr. Phillips can hoe his garden in 3 hours. His son, Walter, can hoe it in 5 hours. How long will it take them working together?

7. Make an original problem in partnership from your own experience, if possible. Make it easy enough to be solved without pencil.

55.* *Extraction of Square Root.*

When a number is made up of two or more equal factors, one of these factors is called the *root* of the number. If a number is composed of two equal factors, one of these factors is called the *square root* of the number. If the number is composed of three equal factors, one factor is called the *cube root* of the number.

1. *For study.* The 38 men of the Radio Corps were arranged for drilling purposes in as large a square as possible. This left 2 men out. How many men were in rank? In file?

× × × × × ×
× × × × × ×   38 men in the R. C.
× × × × × ×   2 men out
× × × × × ×   36 men in square
× × × × × ×   Six men were ar-
× × × × × ×   ranged in rank and
(over) × ×   6 in file.

To square 6 we write it: $6^2 = 36$. To find the square root of 36, we write it: $\sqrt{36} = 6$. The sign $\sqrt{}$ is called the *radical sign*. Consult dictionary for *radical*.

2. Give the square roots of the following:

  a. 9   *b.* 25   *c.* 49   *d.* 81   *e.* 144

3. What is the largest perfect square in each of the following:

a.	*b.*	*c.*	*d.*
7	10	14	17
26	38	54	69
83	95	103	150

4.* *For study.*

Find the square root of 676.

Write	Think
26	
676	
400	$20^2 = 400$
$2 \times 20 = 40$ 276	$276 \div 40 = 6 +$
6×46 276	$6 \times (40 + 6)$
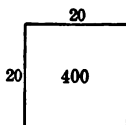
Compare with cut on page 243.

5. How many figures in the squares of numbers from 1 to 9 inclusive? Prove. How many figures in the squares of numbers from 10 to 99 inclusive? Prove.

6. How many figures in the square root of each of the following?

a. 64	*b.* 49	*c.* 81	*d.* 36
169	225	324	256

56. *Rule for Finding Square Root.*

Separate the number into periods of two figures each, beginning at units or the decimal point.

Find the greatest square in the left-hand period and write its root for the first figure of the required root.

Square this root, subtract the result from the left-hand period and annex to the remainder the next period for a dividend.

Double the root already found, for a partial divisor, and by it divide the dividend, disregarding the right-hand figure. The quotient, or quotient diminished, will be the second figure of the root.

Annex to the partial divisor for a complete divisor the figure last found, multiply this divisor by the figure of the root last found, subtract the product from the dividend, and to the remainder annex the next period for the next dividend.

Proceed in this manner until all the periods have been used. The result will be the square root sought.

~~Find the square root of:~~

1. 784	**9.** 7225	*For study:*
2. 289	**10.** 4096	$\sqrt{4489}$ = ?
3. 1444	**11.** 2704	
4. 4624	**12.** 2209	67
5. 256	**13.** 1225	$\overline{44\cdot89}$
6. 324	**14.** 1600	36
7. 576	**15.** 2304	127 | 889
8. 1089	**16.** 1296	889

57. *Building a Home: II — The Pythagorean Theorem.*

Mr. Layman: Good morning. You have begun early. Are those four stakes to be the corners of the house?

Mr. Hedrick: They are trial stakes. We have placed them temporarily and now are about to test them out.

(Mr. Hedrick then drives two stakes, one six feet east and the other eight feet north of the stake at the southwest corner. He readjusts the placing of these stakes until a 10-foot rod laid diagonally will just touch both stakes.)

Mr. Layman: You are using the old Pythagorean Theorem. I learned it long ago in school, but this is the first time I knew of this application of it.

Mr. Hedrick: Carpenters make constant use of it with their squares.

Mr. Layman: Yes, I suppose everybody uses it. No one has to tell a boy who cuts a corner that the diagonal is shorter than walking around the two sides of the triangle, although he does not know the Greek name *hypotenuse* for it.

Mr. Hedrick: Now it is an easy matter to extend this north line and repeat the process in the other three corners.

Mr. Layman: The result will be that I shall have a house whose opposite sides are parallel and whose corners are true right angles.

58.* *Applications of Square Root.*

1. *For study.* What is the length of the *hypotenuse* (the diagonal line opposite the right angle) in a triangle whose other two sides are respectively 3 inches and 4 inches long?

Count the small squares in *a* and *b*. Count the small squares in *c*. What do you discover?
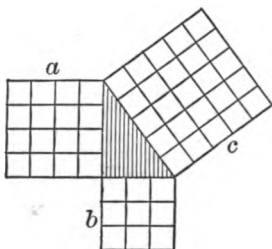
3 in.^{2} + 4 in.^{2} = 25 sq. in.

25 sq. in. = area of 5-in. square.

The hypotenuse is 5 inches long.

<div align="center">Solution</div>

Let x = length of hypotenuse

Then x^2 = 3 in.^{2} + 4 in.^{2}

x^2 = 25 sq. in.

$x = \sqrt{25 \text{ sq. in.}}$ = 5 inches

The hypotenuse is 5 inches long.

It is claimed that Pythagorus, a Greek philosopher, who lived about 500 B.C., made this discovery of the area of the square erected upon the hypotenuse. It has been suggested that if we should try to communicate with Mars this figure might be drawn upon the Sahara Desert with powerful lights. Can you tell why?
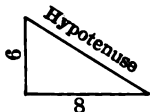
2. What is the length of the hypotenuse in a triangle whose other sides are respectively 6 and 8?

3. Belle laid out a triangular garden. The two sides which met at a right angle were 9 and 12 feet long respectively. What was the length of the third side?

4. A ladder 20 feet long leans against a wall from which its base is separated by a distance of 16 feet. At what height does it strike the wall?

5. A straight wagon road runs directly northwest for 15 miles. It starts 9 miles east of Centerville and crosses the railway directly north of it. How far north of Centerville does it cross the railroad? Drawing.

59. *Comparative Solutions.*

1. *For study.* I lost \$35, which was $\frac{5}{8}$ of all my money. How much had I at first?

1. By fractions: $\$35 \div \frac{5}{8} = \overset{7}{\cancel{\$35}} \times \frac{8}{\underset{1}{\cancel{5}}} = \$56.$

2. By percentage (decimals): $\$35 \div .625 = \$56.$

3. By proportion: $5 : 8 = \$35 : \$56.$

4. By cancellation: $\dfrac{8 \times \overset{7}{\cancel{\$35}}}{\cancel{5}} = \$56.$

5. By algebra: Let $x =$ my money.
$$\frac{5x}{8} = \$35$$
$$5x = \$280$$
$$x = \$56$$

I had \$56 at first.

Solve in not less than two ways:

2. I sold a house for \$8000. This was a gain of $\frac{1}{4}$ of the cost. Find the cost.

3. After traveling $\frac{5}{12}$ of the journey, I had 42 miles yet to go. What was the length of the whole journey?

4. Two boys together sold 50 newspapers. Bob sold 4 times as many as Julius. How many did each one sell?

5. I sold a plow for \$4 that had cost me \$5. The selling price was what per cent of the cost?

60. *Find the value of:*

1. $(3\frac{3}{4} \div \frac{2}{3}) - 3\frac{1}{4} + 2\frac{1}{2} + 1\frac{2}{3} = ?$

2. $(3\frac{3}{5} \div 2\frac{1}{4}) \div (5\frac{1}{2} \times \frac{4}{7}) = ?$

3. $7\frac{1}{3} + 2\frac{1}{5} - 6\frac{1}{3} + 3\frac{1}{3} \times 2\frac{1}{5} = ?$

61. *Find the missing term:*

1. $2\frac{1}{3} : ? = 7 : 21$

2. $7\frac{1}{2} : 15 = ? : 28$

3. $? : 25 = 9 : 27$

4. $2\frac{5}{6} : ? = 9 : 63$

5. $? : 17\frac{1}{2} = 1\frac{1}{5} : 6$

6. $\frac{5}{6} : 2\frac{1}{4} = ? : 75$

7. $? : 50 = 12\frac{1}{2} : 100$

8. $4\frac{1}{5} : ? = 8\frac{1}{3} : 16\frac{2}{3}$

62. *Written Problems.*

1. Richard, James and Henry formed a partnership to sell fruit. Richard invested $48, James $60 and Henry $72. If they gained $60 the first week, what was each partner's share in the profit?

2. A dealer bought 350 tons of ice for $2100. He sold the ice at the rate of 40¢ a hundred pounds. What was his per cent of gain?

3. Find the proceeds of a note for $500, payable in 90 days, with interest at 6%, if discounted at a bank at 6%, 40 days after date.

4. A house and lot cost $5000; the insurance is $25, taxes are $50 and repairs $75 annually. What rent must be received in order to realize 6% on the investment?

5. In the fall of 1916 Illinois had approximately 2,362,000 acres sown in winter wheat. In 1917 the area was approximately 2,934,000. This was an increase of what per cent?

6. A schoolhouse costing $9600 is to be built in a district whose property is valued at $1,920,000. Find (*a*) the rate of taxation for school purposes, (*b*) the amount of tax to be paid by a man whose property is valued at $6500.

7. How much walking does a man save by crossing a field 28 rods long and 21 rods wide diagonally instead of going along the end and the side?

8. A rectangular field whose length is 4 times its breadth requires 350 rods of fence to inclose it. What are the dimensions of the field? Algebra.

9. Three families, consisting of 3, 4 and 5 persons respectively, camped out during the summer months. The expenses amounted to $606. What number of dollars should each family pay?

10. If a boy buys marbles at the rate of 5 for 2 cents, and sells them at the rate of 4 for 3 cents, how many must he buy and sell to make a profit of $4.20?

11. A house worth $12,000 was insured for $\frac{7}{8}$ of its value by three companies; the first took $\frac{1}{3}$ of the risk at $\frac{1}{2}$%, the second $\frac{1}{2}$ of the risk at $\frac{1}{4}$%, the third the remainder at $\frac{3}{8}$%. What was the whole premium paid?

12. If I sell $\frac{2}{3}$ of a farm for what $\frac{4}{5}$ of it cost, what is my per cent of gain?

13. In a certain quantity of milk the ratio of the cream to the rest of the milk is as 2 to 9. How many pounds of cream are there in 243 lb. of the milk?

14. I sell goods at 20% below the marked price and still make a profit of 10%. What per cent above cost was the marked price?

15. A locomotive runs $\frac{3}{4}$ of a mile in $\frac{4}{5}$ of a minute. At what rate an hour does it run? (Give analysis in full.)

16. A note for $750, without interest, is payable in 90 days. On the day the note is made it is discounted at a bank at 6%. Find the proceeds.

17. If $\frac{3}{16}$ of a farm is worth $360, find the value of $\frac{5}{8}$ of it.

18. At 4 mills on the dollar, how much tax must be paid on property valued at $15,450?

19.† The sum of two odd numbers and the difference between them are always what kind of numbers? Discover for yourself.

20. During spring vacation Clarence worked in his garden 5 times as long as Fred worked in his. Together they worked 48 hours. How many hours did each work? Solve in two ways.

† See Table of Contents.

63.* *Multiplication by Factors.*

1. *For study.* $48 \times 54 = ?$

Old Method	New Method
54	54
48	6
432	324
216	8
2592	2592

2. $24 \times 964 = ?$
3. $72 \times 389 = ?$
4. $36 \times 452 = ?$
5. $63 \times 958 = ?$
6. $32 \times 756 = ?$

64. *Subtract:*

1. $4816\frac{1}{4}$ **3.** $9214\frac{1}{4}$ **5.** $7112\frac{3}{7}$ **7.** $5715\frac{3}{8}$
     $2987\frac{1}{2}$ $3897\frac{2}{3}$ $5896\frac{7}{8}$ $3827\frac{2}{3}$

2. $4002\frac{1}{4}$ **4.** $6902\frac{7}{8}$ **6.** $3426\frac{1}{5}$ **8.** $7900\frac{1}{2}$
     $3924\frac{5}{6}$ $5985\frac{5}{6}$ $2978\frac{4}{9}$ $3986\frac{1}{4}$

65. *At sight:*

1. $2.36 \div .2 = ?$ **5.** $.072 \div .8 = ?$ **9.** $1 \div 25 = ?$

2. $4 \div .08 = ?$ **6.** $.678 \div .06 = ?$ **10.** $.045 \div 900 = ?$

3. $5.2 \div .05 = ?$ **7.** $27.06 \div .11 = ?$ **11.** $.306 \div 6 = ?$

4. $.84 \div 1.2 = ?$ **8.** $.0236 \div .04 = ?$ **12.** $25 \div .125 = ?$

66. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
768	968	978	897	988	789
657	986	878	796	647	978
886	869	767	488	759	677
657	997	658	569	669	989
369	768	558	688	978	578
589	496	438	639	989	869
477	778	858	278	489	667
988	678	768	977	597	389
939	387	979	989	698	678
899	597	979	798	578	898

67. *Building a Home: III — Actual Construction.*
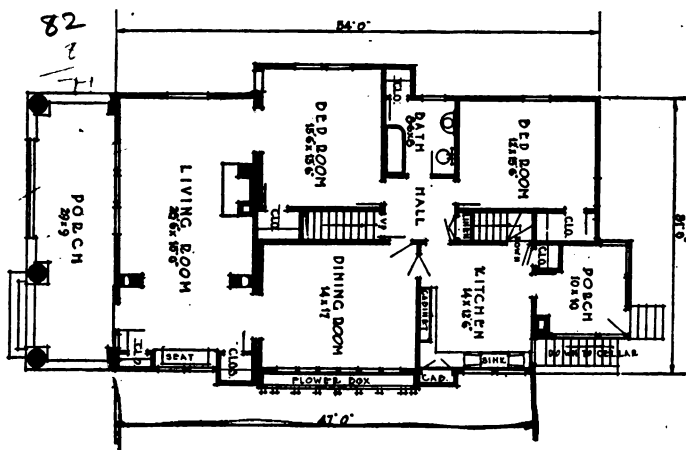
1. The plans for Mr. Layman's house were drawn to a scale of $\frac{1}{16}''$ to the foot. What was the length and the width of the house? What were the dimensions of the living room?

2. The basement extended the entire width under the house and 30 feet from the rear wall to the front. It was dug an average of 9 feet below the level of the lot. What was the cost of removing the earth at $1.80 a cubic yard?

3. The concrete foundation for the house was 12″ thick and 8′ deep. How many cubic yards of concrete were needed? What was the cost at $10.50 a cubic yard?

4. The interior partition walls of the basement were also made of concrete. They added 40% to the cost of the exterior foundation walls. What was the complete cost of the foundation?

5. The floor of the basement was cemented at a cost of 24¢ a sq. ft. What was the cost for the floor?

6. By investigation find out what each of the following is:

a. Sill	*c.* Beam or joist	*e.* Rafter
b. Girder	*d.* Studding	*f.* Brace

A 12" Board
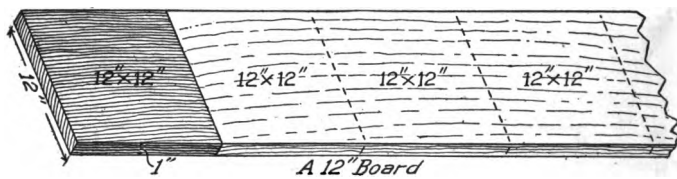
Mr. Hedrick, the contractor, in estimating the lumber he needed, used what is known as a *board foot*. A board foot is a square foot one inch or less in thickness.

To find the number of board feet in any piece of lumber, multiply the number of square feet on one face by the number of inches in thickness.

7. Copy this sales slip. Fill out all the amounts:

HOME LUMBER COMPANY

Yard at 23–43 West 23d Street

DAVENPORT, IOWA

May 1, 1920

Deliver to *William C. Hedrick*
Address *56 Michigan St., Davenport, Iowa.*

Pieces	Size	Length	Kind	Price per 1000 ft.	Amount	
4	6″ × 8″	20 ft.	Hemlock	$32.00	?	?
40	1″ × 10″	12 ft.	Pine	34.00	?	?
20	2″ × 3″	14 ft.	Spruce	30.00	?	?

8. From what you already know make original problems on the plastering, painting, and papering of Mr. Layman's house. **Buy** furniture for it.

68. *Oral Problems.*

1. The annual rent of a house is $360, which is 12% of its value. What is the value?

2. Mr. Ashton's property is assessed at $3000 and the rate is $2.10 per $100. How much is his tax?

3. A merchant sold some electric fixtures for $120, clearing ⅓ of their cost. What per cent would he have lost if he had sold them for $80?

4. A train running 50 miles per hour is 36 minutes in going from one station to another. How far apart are the stations?

5. How long will it take $500 to amount to $800 when loaned at 10%?

6. Two men hire a pasture for $45. One puts in 15 cows and the other 12 cows. What should each pay?

7. Which is better for the customer, a straight discount of 30% or a continued discount of 20% and 10%?

8. The ratio of 6¢ to one dollar equals the ratio of what amount to $200?

9. A man and his son receive $36 for a week's work. The son earns ½ as much as his father. In what time will the son earn as much as the two can earn in one week?

10. A grocer bought molasses at the rate of 60¢ a gallon and sold it at a gain of 25%. How much did he make on 36 gallons?

11. Albert can do a piece of work in 3 hours. He and his brother can do it in 2 hours. How long will it take the brother alone?

12. Harold is ⁴⁄₇ as old as his father, and the sum of their ages is 70 years. How old is each?

13. A fishing rod, the length of which is 24 feet, is in two parts. ⅝ of the longer equals the shorter. How long is each part?

14. Of 200 pupils 6% have been tardy or absent this month. How many have not been tardy or absent?

69. *Written Problems.*   (Proportion where possible.)

1. When 10 pairs of shoes cost $72, what will 15 such pairs cost? 25 such pairs?

2. Estimate the length and breadth of your school-room floor. How much would it cost to oil it at $1\frac{7}{8}$¢ per square yard?

3. When 2 dozen eggs cost $1.44, how much will $\frac{2}{3}$ dozen cost?

4. A calendar back measures 11 inches by 14 inches. From paper which measures 22 inches by 28 inches at $16\frac{1}{2}$ cents a sheet what would be the cost of supplying a class of 40 pupils with material to make calendars?

5. When $\frac{1}{4}$ of a bushel of potatoes is worth 60¢, how much must I pay for $\frac{3}{8}$ of a bushel?

6. A lumber rack is $9\frac{3}{4}$ feet high. How many boards $\frac{3}{4}$ of an inch thick are stacked upon one another?

7. If a $5\frac{1}{2}$ lb. roast costs $2.20, how much will an 11 lb. roast cost at the same price per pound?

8. Francis pays 75¢ for 18 agates. At that rate what must Spencer pay for 12 agates?

9. How many gallons of water in 36 cubic feet of water? Each cubic foot of water contains about $7\frac{1}{2}$ gallons. Who needs to make measurements like this?

10. When 9 cords of wood cost $72, how much must be paid for 16 cords?

11. The difference between the original sale price and the marked price in a clearance sale was $15. The proprietor still made a profit of $10. If the cost had been $100, give the original sale price and the final one. Make two original problems using the data furnished which will necessitate the use of percentage.

12. How many strips of sod $1\frac{5}{8}$ feet wide are required to sod a piece of ground 22 feet wide?

13. A rope $\frac{3}{8}$ of a yard long is what part of one $2\frac{5}{8}$ yards long?

14. Lucy found that some photographs which she made of her schoolmates cost $9\frac{3}{4}$¢ each. She mounted them upon

cards that cost $2\frac{3}{4}¢$. How much did one dozen pictures cost her?

15. Mrs. Adams buys $6\frac{1}{2}$ yards of crash at $.43 a yard; 12 yards cheesecloth at $18\frac{3}{4}¢$ a yard; 5 spools of thread at 9¢ each; $2\frac{1}{2}$ yards table linen at $2.50 a yard. Make and receipt the bill.

16. A fire destroyed 2800 bushels of grain, which was 40% of the cargo. The remainder was sold at $2.20 per bushel. How much was received for it?

17. A wholesale drug firm makes an average daily profit of $179. How long will it take the firm to earn a profit of $16,647?

18. A playground is 80 rods long and 37.5 rods wide. What did it cost to fence it at $4\frac{1}{2}$ per rod?

19. Two boys who received $48 from the sale of vegetables from their garden divided the money equally. The first boy spent $37\frac{1}{2}$% of his money which was just half as much as the second boy spent for the same purpose. How much money had each boy left? What per cent of the original sum had they spent?

20. If it takes 2 ounces of butter for a plain cake, how much will the butter for 3 such cakes cost at $.64 a pound?

21. What is the price of a barrel of flour (196 lb.) at $6\frac{1}{4}¢$ per pound?

22. Mrs. Andrus can make $2\frac{1}{4}$ aprons in a day. At that rate how long will it take her to make 60 such aprons?

23. If it takes $\frac{3}{8}$ yd. of lace to make a lace collar, how many such collars can be made from 6 yards of lace?

24. A grocer bought 10 bushels of new potatoes at $2.25 a bushel and sold them at 2 pounds for 15¢. What was his profit? One bushel of potatoes weighs 60 pounds.

25. Mrs. Nelson bought a dining room set for $104 which was $\frac{1}{5}$ less than the marked price. What was the marked price?

26. What width floor can be covered by 8 strips of carpet $\frac{3}{4}$ yd. wide?

70.* *Special Insurance.*

1. Automobile Insurance. There are four kinds of automobile insurance: fire, theft, collision and liability. What is the purpose of each?

a. What justification do you see in a company's charging the same premium for fire insurance a second year and at the same time reducing the face of the policy 50%?

b. What justification do you see in a company's refusing to pay for damages to a machine when the amount is less than $25?

c. What justification do you see in a company's limiting its liability to $5000 in case of suit against the holder of the policy?

2. Workmen's Compensation Law. Practically all the states have a special law to protect the public when a man through accident in his occupation is thrown out of work. It is argued in such case that the employer should be compelled to pay the employee a certain per cent of his average weekly wage in order that he and his dependents may not become a burden upon a community not responsible for the accident.

a. Mike Mieck, who worked in a foundry in Michigan City, Indiana, had his leg broken. His employers paid his hospital bill of $85 and 55% of his average weekly wage of $21 a week for a period of 10 weeks. What was the entire amount of their bill?

b. The Workmen's Compensation Law in one state is inconsistent within its own terms and allows of two constructions for the relief of the injured employee. By which construction of the law should an employee earning $30 a week (compensation 55%) receive the more money and how much? 1. The employee is allowed compensation for 30 weeks for each finger lost and 60 weeks for a thumb. Why is a thumb more valuable to a workman than a finger? 2. The employee is allowed compensation for 150 weeks for the loss of an arm to the elbow.

71.* *The Redfield Lumber Company — Stocks and Bonds.*

No. *29*   *12* shares

Incorporated under the Laws of the State of Illinois

REDFIELD LUMBER COMPANY

Capital Stock, $20,000

Redfield, Ill. *Oct. 29, 1919.*

This certifies that *J. C. Lee* is the owner of *Twelve* shares, of One Hundred Dollars each, of the capital stock of the Redfield Lumber Company.

Transferable only on the books of the Company in person or by attorney upon surrender of this certificate.

John Wilson,   *William R. Hapgood,*
        Secretary.   President.

Scene I: The annual meeting of the stockholders.

Mr. Hapgood (president): Ladies and gentlemen, this is the end of our first year of business. We find ourselves highly prosperous. Mr. Whitcomb, will you read the treasurer's report?

Mr. Whitcomb (treasurer): Mr. President and stockholders, on the 20th of October, 1919, the Redfield Lumber Company was incorporated with a capital stock of $20,000 consisting of 200 shares of $100 each. Of the total stock issued, the president, the secretary and the treasurer each subscribed $4000. The remaining $8000 has been sold to you, citizens of our little town. We found no trouble in selling all the shares at par ($100).

The Board of Directors has declared and paid to the stockholders dividends amounting to $1200 or ——% of the capital. As a result many of our stockholders have already made suggestions as to methods by which we can increase our business for the coming year.

The record of the year's business is as follows:

Total stock........................	$20,000	
For office and yard........................		$1,000
For coal, lumber, cement, lime, sand and brick purchased in carloads.....................		28,000
For taxes, insurance and incidentals.............		700
Salary of Albert Lyons, manager...............		1,200
Salary of James Sims, yard man................		600
Total sales to date....................	32,700	
Dividends paid.............................		1,200
Balance on hand...........................		20,000
	$52,700	$52,700

Mr. Hapgood: What shall we do with the treasurer's report?

Mr. Perry (stockholder): Mr. President, I move the adoption of the report.

Mrs. Elliott (stockholder): Mr. President, I second the motion.

Mr. Hapgood: It has been moved and seconded that we adopt the treasurer's report.   Are you ready for the question?

Stockholders: Question.

Mr. Hapgood: All in favor of the motion signify by saying "Aye."

Stockholders: Aye.

Mr. Hapgood: Contrary, "No." The treasurer's report is adopted.   What is the further pleasure of the meeting?

Mr. Day (stockholder): Mr. President, I am sure we are indebted for a large part of our prosperity to the efficient management of Mr. Lyons. Perhaps Mr. Lyons would offer us some suggestions for still further increasing our business.

Mr. Hapgood: As one means of expressing our general approval of his services, I asked Mr. Lyons several weeks

ago to make some investigations along the line suggested by Mr. Day. Mr. Lyons, will you report the result of your inquiries?

Mr. Lyons: Mr. President and stockholders, it has been suggested by Mr. Hapgood and several others of the stockholders that it might be wise to buy out our rival and neighbor, the Merrill Lumber Company. Upon investigation, I find that they have not been so prosperous this year as we. As a result they have made us a formal offer of their stock at a cash price of $15,000. They draw their trade from practically the same territory and the combined business is not too great to be handled under one management. The overhead (office, etc.) expenses for the two yards would be cut down at least 30% while the sales should materially increase.

Mr. Collins (stockholder): Mr. President, I am not in favor of making this purchase. We should let well enough alone.

Miss Washburn (stockholder): Mr. President, I take the opposite view. I am heartily in favor of this purchase. It will enlarge our business. Our stock has been at a premium for months and yesterday it was quoted at 106 (106% of par). Such public expression of confidence, in my opinion, warrants us in making this purchase.

Mr. Roberts (stockholder): Mr. President, it seems to me that the final decision in this matter should be left to the Board of Directors. I move that if, in their judgment, we shall profit by purchasing the stock of the Merrill Lumber Company, the Board be empowered to proceed.

(*Formal permission having been obtained, all vote in favor of the motion made by Mr. Roberts, except Mr. Collins. Each stockholder is allowed one vote for each share of stock owned by him.*)

Mr. Lee (director): Mr. President, as chairman of the Board of Directors, I wish to ask advice as to the manner in which we shall raise the money for this purpose. Shall we

enlarge the company by a second issue of stock, either common or preferred (see page 263) or shall we mortgage our property and borrow the money? If the latter way is preferred, shall we borrow from one individual or shall we issue bonds? (See page 263.)

(By a final vote upon the matter following a prolonged discussion, the Board of Directors is authorized to issue thirty $500 first-mortgage bonds bearing 5% interest and payable six each year beginning with the year 1921.)

REDFIELD LUMBER COMPANY
Redfield, Illinois.

Number $500.00
  7

Five Per Cent First Mortgage Gold Bond

Know all men by these presents, that the Redfield Lumber Company is justly indebted to the bearer hereof in the sum of

FIVE HUNDRED DOLLARS

which sum the undersigned hereby promises to pay to the bearer on the 1st day of December, 1921, together with interest thereon at the rate of five per cent per annum from the date hereof, on the 1st day of December and the 1st day of June in each year up to and including the date of maturity of said bonds, on presentation and the surrender of the annexed interest coupons as they shall severally become due as provided herein. Both principal and interest are payable in gold coin of the United States.

It is expressly agreed that if default be made in the payment in any one of the installments of the interest aforesaid then the said principal sum of $500 shall at once become due and payable.

This bond is one of a series of thirty bonds of $500 each the payment of which is secured by mortgage of all the property of the Redfield Lumber Company.

1st day of December, 1920.

By *William R. Hapgood*,
               President
    John Wilson,
               Secretary.

Continue the dramatization: II. Sale of bonds. III. Payment of interest to holders of bonds on presentation of

coupons.   IV. Redemption of six bonds on December 1, 1921.

72. *Additional Information on Stocks and Bonds.*

A stock company is said to be *incorporated* when it has a permit or *charter* granted it by the state in which it intends

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Interest Coupon

No. 1 $12.50

On the 1st day of June, 1920, due at the Redfield Lumber Company to bearer $12.50, being for six months' interest upon Bond No. 7 of even date herewith, for the sum of $500.00.

Dated December 1, 1920.

Elias Whitcomb   Treasurer

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to do business.   It is then called a *corporation.*

The *capital stock* of a company is usually divided into *shares,* frequently $100 each.   The persons buying these shares are called *stockholders* in the corporation.   The receipt (see page 259) given the stockholder stating the number of shares he has purchased and the value of each, is called a *stock certificate.*

At stated periods, often quarterly, the net profits of the business are divided among the stockholders in proportion to the number of shares which each holds.   These are called *dividends* and are declared as a per cent of the face or *par value* (not market value) of the stock.

Many companies have two kinds of stock, *common* (such as issued by the Redfield Lumber Company) and *preferred.* Preferred stock entitles the holder to a fixed rate of dividend before the common stock can receive any dividend.   For example, the stockholders of the Redfield Lumber Company had they chosen, could have issued additional common stock or additional preferred stock on which 5% dividends were to be paid before the original stockholders received any dividends.   In the latter case, the new stock would be preferred stock.

Bonds are promissory notes to be paid at a specified time. Governments have the power by law to borrow money. For example, in 1917, the United States government needed a two billion dollar war loan.   Liberty Bonds were issued

in accordance with a specific act of Congress and were bought by citizens all over the United States   Townships raise money for roads, cities raise money for public buildings, bridges, etc., by issuing bonds.

Bonds are of two kinds: (1) *registered bonds* which bear the purchaser's name and are not transferable without his endorsement and (2) *coupon bonds* which do not bear the purchaser's name.   The interest upon a coupon bond may be collected by anyone holding the detached interest coupon. Bonds are usually issued for $1000 or $500.

New York, Chicago and other large cities have markets in which stocks and bonds are bought and sold by commission merchants.   Such a market is called a *stock exchange* and the commission merchants are called *stockbrokers*.   Wall Street in New York City is the most famous stock exchange in this country.   All stock is sold by auction in a stock exchange and the stock brokers charge a fixed fee of $\frac{1}{8}$ of 1 per cent on the par value, called brokerage.

Why are bonds usually a safer investment than stocks? Why are people willing to buy government bonds at a very low rate of interest?   Why is it unsafe to buy stocks or bonds which offer a very high rate of interest?   Over 5% interest is usually considered hazardous.   Dividends are paid on ――――, interest is paid on ――――.   Stockholders have the right to vote while bondholders have not.   In what way did the stockholders of the Redfield Lumber Company keep the control of the business in their own hands by issuing bonds rather than additional stock?

Bring to school that page in your daily paper which is devoted to stocks and bonds and learn to read it.

73. *Problems in Stocks and Bonds.*

Unless otherwise indicated, par value will be considered $100 per share.

1. Mr. Collins who owned 2 shares of the Redfield Lumber Company sold them at 106.   How much did he receive for them?

2. Previous to his sale, Mr. Collins had received a 6% dividend from the company. What was his entire profit on his two shares from dividends and from his sale?

3. Mr. Frank Browning purchased two shares of stock from Mr. Collins at 106. He received at the end of the year a dividend of 8%. What per cent did he make on his investment?

4. Mrs. Eliza Saltmarsh purchased two $500 bonds issued by the Redfield Lumber Company and payable two years after date with 5% interest. How many coupons did she present? How much interest did she receive each time? In all?

5. If the Redfield Lumber Company redeemed six bonds on December 1, 1921 and paid interest at 5% on thirty $500 bonds, how much did it pay?

6. What was the gross profit of the company if in addition to caring for its bond issue, the Redfield Lumber Company paid a dividend of 8%?

7. Mr. Pedlow invested $34,200 in Belt Railway stock at 114. How many shares did he buy?

8. If he should receive a semiannual dividend of 6%, what is his annual income therefrom? What per cent does he receive on his money?

9. How much did Mr. Hoover pay for 5 shares of rolling mill stock at $500 each with brokerage at $\frac{1}{8}$%?

10. Mr. Poe sells 40 shares of stock at 108. He bought them at par. Find his profit after deducting $\frac{1}{8}$% brokerage.

11. Mr. Lain bought 50 shares of stock at 105. He received a dividend of 8%. What was the amount of his income? What was the per cent of profit on his investment? Par value $25.

12. I bought bonds at $120\frac{7}{8}$ and sold them at $124\frac{1}{2}$. How much will I make on 700 bonds if I must pay $\frac{1}{8}$% brokerage on each transaction?

74. *Written Problems.*

1. A carriage wheel revolves 2 times in going 25 feet. How many times will it revolve in going a mile?

2. Prove that the difference between a number and the digits of that number written in reverse order, is divisible by 9.

3. If sound travels at the rate of 1090 feet per second, how far distant is a thundercloud when the sound of the thunder follows the flash of lightning after 8 seconds?

4. Change 22.5 minutes to the decimal of an hour.

5. Make a receipted bill for the following: C. E. Fortney bought of Harris, Smith and Company, Troy, New York, 37 bushels of oats at 90¢ a bushel; 50 bushels of corn at $1.95 a bushel; 76 bushels of wheat at $2.15. Date the bill to-day.

6. The assessed valuation of a certain district is $3,250,000 and the amount to be raised by tax is $8125. What is the rate of taxation? What is the tax of a man whose property is assessed at $5000?

7. After traveling 34.875 miles, how far must a man go to travel 50 miles?

8. How long must a wire be to stretch from the top of a telephone post 60 feet high to a stake 45 feet from the base of the pole? Drawing.

9. My garden is 80 × 100 feet. What will a concrete walk bordering the inside cost at $2.16 a square yard, the width of the walk being 3 feet? Drawing.

10. A growing crop of wheat was insured at 5%. The premium was $130. What was the face of the policy? Under what circumstances might the insurance be collected? What determines this?

11. A man owed me $1550. My agent collected 80% of it and charged 5% commission. How much did I receive?

12. What are the proceeds of a note for $1250 at 5% dated Nov. 26, 1918, and due in 90 days, discounted Jan. 10, 1919, at 6%?

13. At the experimental station of an agricultural college it was found that soil which had been fertilized produced $7\frac{1}{2}$ tons to the acre while that which had not been fertilized produced only 4.6 tons to the acre. What was the per cent of gain due to the fertilization?

14. Mr. Barnard bought a house and lot for $6835. He repaired the house at a cost of $1250. The house was burned and he received $3575 insurance. He then sold the lot for $4516. Did he gain or lose and how much?

15. The exports of the United States during a recent year amounted to $1,500,000,000. During the same year our imports amounted to $1,000,000,000. What was the ratio of our imports to our exports?

16. A man owns 60 shares of Indianapolis Street Railway stock. If the company declares a dividend of 5% payable in stock, how much stock will he then own?

17. What is the premium for insuring a house worth $16,200 for $\frac{2}{3}$ of its value at $\frac{3}{4}$%?

18. Write in correct form a check on the Fifth National Bank for $125.30 in payment of a bill of goods.

19. What is the compound interest on $976 for 2 yr. 6 mo., at 6%, compounded semiannually?

20. What is a pile of wood 16 ft. long, 8 ft. wide and 4 ft. high worth at $6.50 a cord?

21. The directors of a company whose capital is $50,000 determined to distribute among the stockholders profits amounting to $2500.

    a. A dividend of what per cent shall be declared?

    b. How much will a man receive who owns 15 shares?

75.* *Division by Factors.*

1. *For study.* $888 \div 24 = ?$

Old Method.	New Method.

$$
\begin{array}{r}
37 \\
24\overline{)888} \\
72 \\
\hline
168 \\
168 \\
\hline
\end{array}
$$

$$
\begin{array}{c}
111 \\
\dfrac{888}{24} = 37 \\
3
\end{array}
$$

2. $384 \div 64 = ?$
3. $1736 \div 28 = ?$
4. $7074 \div 54 = ?$
5. $3570 \div 42 = ?$
6. $972 \div 36 = ?$

76. *Solve by short method.*

1. $450 \times 33\frac{1}{3} = ?$

2. $864 \times 25 = ?$

3. $356 \times 50 = ?$

4. $728 \times 12\frac{1}{2} = ?$

5. $580 \times 25 = ?$

6. $672 \times 12\frac{1}{2} = ?$

7. $320 \times 6\frac{1}{4} = ?$

8. $477 \times 33\frac{1}{3} = ?$

9. $594 \times 16\frac{2}{3} = ?$

10. $736 \times 25 = ?$

77. *Find the value of:*

1. $2\frac{1}{2} \times 3\frac{1}{3} - 2\frac{2}{5} \div 3\frac{1}{5} = ?$

2. $7\frac{1}{2} + 9\frac{1}{3} + 4\frac{4}{8} \times 2\frac{1}{2} = ?$

3. $9\frac{3}{5} \times 2\frac{2}{3} - (5\frac{1}{3} + 3\frac{1}{2}) = ?$

4. $5\frac{5}{8} \div 1\frac{3}{4} \times \frac{2}{3} \div \frac{3}{8} = ?$

5. $8\frac{3}{8} - 4\frac{1}{2} + 2\frac{1}{2} \times 7\frac{3}{5} = ?$

78. *Find the missing term (at sight):*

1. $114 + 3 = 19 + ?$

2. $\frac{2}{3}$ of $24 = 32 \div ?$

3. $7\frac{1}{2} - 3\frac{1}{2} = 2\frac{1}{6} + ?$

4. $8\frac{1}{3} \times 12 = 12\frac{1}{2} \times ?$

5. $50 \div 12\frac{1}{2} = 100 \div ?$

6. $124 - 9 = 100 + ?$

7. $\frac{4}{5}$ of $35 = 23 + ?$

8. $25 + 2\frac{1}{2} = \frac{1}{2}$ of $?$

9. $33\frac{1}{3} \times 9 = 25 \times ?$

10. $78 - 7 = 90 - ?$

79.* *The Area of a Parallelogram.*

A plane surface bounded by four straight lines is called

Square   Rhombus   Rhomboid   Rectangle a *quadrilateral.* When the opposite sides of a quadrilateral are parallel it is called a *parallelogram.*

1. *For study.* How many square inches of leaded glass will be found in one diamond shaped pane which measures 5 inches on each side?

Cut two pieces of paper the size and shape of the pane of glass.

1. Cut the paper into two triangles of equal size. What is the area of each? What is the area of the whole parallelogram?

2. Cut off triangle *a* and add it to the right side of the figure. What is the area of the rectangle we now have? What is the area of the original parallelogram? Why would it be wrong to use one of the sides of the parallelogram for its height?
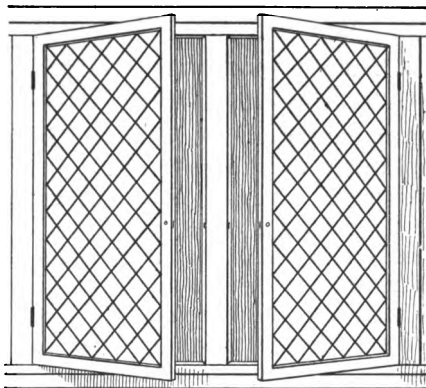
Complete and learn:

    To find the area of a parallelogram multiply the length of its base by its ——, which is not the same as its slant height.

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80. *Find the value of:*

1. $\dfrac{9.6 \times 2.8 \times .063}{4.9 \times .036 \times .16} = ?$ **2.** $\dfrac{1.08 \times 2.4 \times 1.6}{1.44 \times 7.2} = ?$

81. * *Measurements — Some Interesting Facts.*

Centigrade ⸱ 1 Fahrenheit

TEMPERATURE. Scientists commonly use what is known as the Centigrade (100°) thermometer. The freezing point on this thermometer is marked zero and the boiling point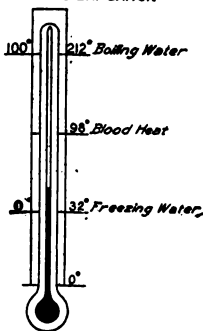 100°. How does this differ from the Fahrenheit thermometer? Degrees above 0° in both systems are marked +, and those below are marked —.

1. Explain the action of a thermometer.

2. Name several commercial processes in which allowance must be made for expansion due to heat.

AIR PRESSURE. A barometer is an instrument similar in appearance to a thermometer. It is used for measuring the pressure of the air. Men engaged in building tunnels or piers for bridges under water find it necessary to work in a steel box in which the air pressure on the inside is equal to the water pressure from the outside. What use can you see here for the barometer? What would happen if the pressure became unequal? The barometer is also used by the Weather Bureau of the United States government to foretell storms.
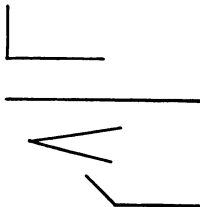
ANGLES. A right angle contains 90°.
A straight angle contains 180°.
An acute angle contains less than 90°.
An obtuse angle contains more than 90°.

LINEAR MEASURE. The statute mile is 5280 feet in length. Three statute miles are called a *league*. The nautical mile, used in measuring distances at sea, is 6,080.27 feet.

POLYGONS.   A polygon is any plane figure bounded by straight lines.   A polygon is regular if both its angles and its sides are equal.
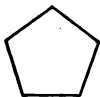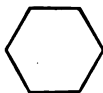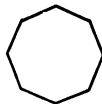
| Pentagon | Hexagon | Octagon |

PRISMS AND CYLINDERS.
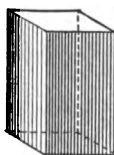
| Triangular Prism | Square Prism | Cylinder |
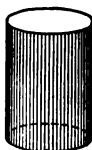
> The lateral surface of a prism or cylinder is equal to the product of its altitude and the perimeter of its base.

Prove that the above is true by making a paper cylinder the diameter of whose base is 4 inches and whose altitude is 8 inches.

> The volume of a prism or a cylinder is equal to the product of its altitude and the area of its base.

PYRAMIDS AND CONES.   A pyramid is a solid whose base is a polygon and whose sides or surfaces are triangles which meet at a common point called the vertex.   The distance from the vertex to any side of the base is the slant height.

A solid whose base is a circle and whose surface tapers uniformly to a point is a circular cone.

In this book cone means right circular cone.

The lateral surface of a pyramid or cone is equal to one half the product of its slant height and the perimeter of its base.

The volume of a pyramid or cone is equal to one third the product of its altitude and the area of its base.

Prove this by making a paper pyramid and a paper cone each having the same base and altitude. Fill the pyramid with sand, using the cone as a measure.

SPHERE. A sphere is a solid bounded by a curved surface every point of which is equally distant from a point within called the center. A great circle divides a sphere into two equal parts called hemi- spheres. A sphere may be divided into a great number of solids that are essentially pyramids.

The surface of a sphere is equal to 3.1416 times the square of the diameter.

The volume of a sphere is equal to one third of the product of its radius and its surface.

THE AREA OF THE TRAPEZOID. A plane figure of four sides only two of which are parallel, is called a trapezoid.

This lamp shade is a TRAPEZOID

The area of a trapezoid is equal to one half the product of its altitude and the sum of its bases.

WOOD MEASURE. A pile of wood 8 feet long, 4 feet wide and 4 feet high (128 cubic feet) is called a cord.

1. How many cords of wood in a pile 16 feet long, 8 feet wide and 10 feet high?

LIQUID MEASURE. The liquid gallon contains .231 cubic inches and the barrel 31½ gallons. A cubic foot contains 1728 cubic inches. Every cubic foot of water will contain 7½ gallons.

SPECIFIC GRAVITY. The specific gravity of a substance is the ratio of its weight to the weight of an equal volume of water.

A cubic foot of water weighs 62½ pounds. A cubic foot of pine weighs 34 pounds. 34: 62.5 = .54: 1. The specific gravity of wood is .54.

TROY WEIGHT. Troy weight is used for weighing gold, silver and other precious substances.

> 48 grains make one tenth of an ounce.
> 480 grains make one ounce.
> 12 ounces make one pound.

APOTHECARIES' WEIGHT. In compounding medicines, it is often necessary to be very careful in weighing small amounts. In apothecaries' weight the pound, the ounce and the grain are the same as in Troy weight. The ounce is divided into eight parts called drams and each dram is divided into three scruples. A scruple equals only 24 grains. What is the meaning of the word *scrupulous?* The prescriptions of all physicians are made out in apothecaries' weight.

> 20 grains make one scruple.
> 3 scruples make one dram.   ℨ
> 8 drams make one ounce.   ℥
> 12 ounces make one pound.   ℔.

82.* *Inverse Ratio.*

1. *For study.* If Albert weighs 100 pounds and James 80 pounds, how far from the fulcrum (point of support) must Albert sit to equalize the weight of James who sits 5 feet from the fulcrum?
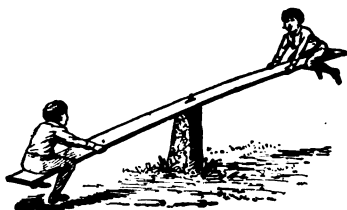
Explanation: Since Albert weighs $\frac{4}{5}$ as much as James, he should sit only $\frac{4}{5}$ as far away from the fulcrum as James if their weights are to be equalized.

Pupils will enjoy demonstrating this principle by home made apparatus.

Solution: 100 : 80 = 5 : ?

$$\frac{\overset{4}{\cancel{80} \times \cancel{5}}}{\underset{20}{\cancel{100}}} = 4$$

Albert should sit 4 feet from the fulcrum.

2. Nancy exerted a pressure of 1 pound in closing the handles of her scissors. Her fingers were 3 inches from the fulcrum while the cardboard which she was cutting was one inch. How much pressure did she use on the cardboard?

3. A laborer wished to move a heavy stone with a crowbar. If the stone weighed 2000 pounds, find the force necessary to lift it by means of a crowbar 5 feet long, supported one foot from the end of the crowbar?

4. If 12 men can do a piece of work in 18 days, how long will it take 4 men to do the same work?

5. A freight train traveling at the rate of 15 miles an hour requires 75 minutes between 2 stations. What time does an express train going 45 miles per hour require for the same trip?

Discuss the principle underlying the construction of the microscope, the telescope, opera glasses, the camera (shutter). Compare a pair of button-hole scissors with a pair of tailors' shears.

83. * *Banking — concluded.*

FEDERAL RESERVE BANKS. In 1913, Congress passed a law establishing in various sections of the country twelve Federal Reserve Banks. All National Banks within the territory assigned to one of the Federal Banks are required to deposit with this bank 6% of the paid-up capital stock and surplus of such bank. State Banks and Trust Companies are permitted to make similar deposits.

This is one of the most important acts of legislation in the history of our country because it furnishes to each bank a reservoir upon which to draw in time of stress, thus averting both local and national panics such as have occurred several times with disastrous results to the whole nation.

FEDERAL FARM LOAN ACT. The Federal Farm Loan Act was passed in July, 1916, for the purpose of making it easy for a farmer who can give good security to borrow money from the government at a low rate of interest.

This is also one of the most important acts of Congress in recent years. Because of the exorbitant rates of interest which farmers have been obliged to pay, the agricultural development of the country has been greatly retarded. A copy of the law can be had by applying to the Treasury Department, Federal Farm Loan Bureau, for Circular No. 4.

BILLS OF EXCHANGE. A *bill of exchange* is a check issued by one bank against another. It may be purchased by an individual for his own use in making payments at a distant bank where his bank has credit. If both banks are in this country, the check is usually called a *bank draft.* If the check is upon a bank in another country, it is usually called a *bill of exchange.* A small fee is charged by the bank.

Banks usually keep money on deposit in some other bank located in a large money center, for the purpose of exchange. For example Robert Ives of Cedarville, Mich., buys from his banker a draft of $50 on the Commercial Bank of New York City. The Cedarville Bank has a deposit in this bank. Mr. Ives mails this draft in payment of a debt to Frank Sims of Dubuque, Iowa. Mr. Sims cashes the draft at his bank in Dubuque. The Dubuque Bank sends the draft to the Commercial Bank in New York and receives payment for it.

The bankers of the country have established a system of exchange both local and national through which checks and drafts are presented to the banks upon which they are drawn. A city exchange is usually called a "clearing house." The bankers have also a National Bankers' Association formed for mutual protection and the promotion of banking interests.

84.* *Government Lands.*

640 acres = 1 section or 1 square mile.
36 sections = 1 township.

Surveying of land

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

A Township

A Location

Congress has adopted a plan by which all public lands are surveyed. Certain parallels of latitude were designated base lines and certain meridians of longitude were designated principal meridians. The intersection of a base line with a principal meridian is the starting point for survey. Government lands are usually laid out in townships 6 miles square, each township containing 36 sections. The sections are always numbered as in the figure. They are also divided into halves and quarters; the quarters into halves and quarters; etc.

1. How many square miles in a township?

2. How many square miles in a section?

3. How many acres in a section?

By the Ordinance of 1787, the sixteenth section in every township in the Northwest Territory was to be sold for the support of schools.

85. *The Age of Air.*

1. *a.* Make three original problems from the following data:

The Atlantic was crossed for the first time:
  By aid of the winds, Columbus in the Santa Maria, in 1492: 70 days.
  By aid of steam, Lt. Roberts in the Sirius, in 1838: 18 days.
  By aid of gas, Com. Read in the N C 4, in 1919: 26 hrs. 37 min.

  b. Show on a graph the relative time required by each trip.

2. The Vickers-Vimy plane left Newfoundland, June 14, 1919, at 4:28 P.M. Greenwich time (New York 11:28 P.M.) and landed in Ireland on June 15 at 8:40 A.M. Greenwich. What time was it then in New York?

New York Time   **Greenwich Time**

3. In July, 1919, the British Dirigible R 34 crossed from Scotland to Long Island in 4½ days covering 3200 nautical miles. What was her rate of speed per hour?

4.† A wind blowing 30 miles an hour toward the side of the plane will blow it 30 miles an hour out of its course. Draw three lines: line *a* to show the necessary course; line *b* to show the course to which the wind would force the plane were it held to the direct course; line *c* to show the course the pilot will take to put his plane in the necessary course.

5.† By complicated and delicate instruments a navigator in the air can at any moment calculate his altitude and his distance from Greenwich. Draw a section of the earth's surface and above it, at different places show an airplane and a fixed star. Show how you think the navigator could use the hypotenuse for calculating his position.

† See Table of Contents.

86.* † *Federal Income Tax — Individual.*

Congress has enacted a law taxing every citizen or resident of the United States and every non-resident alien who has more than the average income, on his income from sources in the United States, as follows:

In 1919 the normal tax was 4% on net incomes over $1000, plus $1000 if head of family, or man or woman if married;

An additional tax or surtax on net incomes over $20,000, as follows:

a. 8% on incomes between $20,000 and $40,000.

b. 12% between $40,000 and $60,000.

c. 17% between $60,000 and $80,000.

k. 61% between $1,000,000 and $1,500,000.

l. 62% between $1,500,000 and $2,000,000.

m. 63% exceeding $2,000,000.

What are some of the arguments for and against an income mode of taxation? What are some of the arguments for and against a low or high basis of exemption? (This law exempted all net incomes under $1000.)

1. *For study.* Miss Kervan owned a business block and several apartment houses. How much income tax did she have to pay on a year's income of $27,800?

<div align="center">Solution</div>

Net Income	$27,800
Exemption	1,000
	$26,800
Normal tax of 4% on $26,800	$1072.00
Surtax of 8% on ($27,800 − $20,000)	624.00
Total income tax	$1696.00
Miss Kervan paid an income tax of	$1696.00

2. Mr. Montaine, married, had a salary of $3000 and received a commission of $2\frac{1}{2}$% on a $240,000 business. What was his income? What was his total income tax?

The same Congress enacted a law taxing all corporations in a similar manner. The provisions are quite complicated.

<div align="center">† See Table of Contents.</div>

87. *Oral Problems.*

1. If an importer buys goods in London to the value of £1000, how much will a draft for this amount cost, exchange being quoted at 4.82½?

2. What is the duty on a painting that cost 2500 francs in Paris at 15% *ad valorem* duty?

3. A city has to raise $200,000 for tax. If the assessed valuation is $10,000,000, what is the rate?

4. At $1.75 per thousand, what is the premium on a fire insurance policy for $2000?

5. Find the cost of 10 shares of stock quoted at 113⅝, brokerage ⅛%.

6. How many acres are there in a field 40 rods square?

7. A company divides $30,000 in dividends, and stockholders receive 6% on their stock. What is the capital of the company?

8. A square floor has an area of 121 square yards. Find its side.

9. A dealer buys $1200 worth of lawn mowers subject to a discount of 6% for cash. How much does he gain by taking the discount? How much does he pay for the lawn mowers?

10. A note for $1500, due in 60 days without interest is discounted at 6%. What are the proceeds?

11. A man takes out a $3000 policy in one company at $24 a thousand, and a $2000 policy in another at $25 a thousand. What are his annual premiums?

12. The hypotenuse of a right triangle is 10 inches and one of the other sides is 6 inches. What is the third side?

13. What is the circumference of a water pipe that is 14 inches in diameter? (3⅐ times.)

14. How many square inches are there on the surface of a 3-inch cube?

88. *Written Problems.*

1. An air ship traveled 72 miles in $\frac{3}{4}$ of an hour. How far did it travel in an hour at the same rate?

2. David can take a running jump over a pole $4\frac{3}{4}$ feet from the ground. His father can jump the pole 17 inches higher. At what height is the pole when the father jumps it?

3. Find the number of times that a stencil unit $9\frac{7}{8}$ inches long can be repeated in a border 22 inches long, if a space of $1\frac{1}{8}$ inches is left between the units?

4. Allen collected 300 foreign stamps. Of this number $\frac{1}{4}$ were stamps from South America, $\frac{4}{15}$ from the Orient and the remainder from Europe. He sold his European stamps for \$5.80. How much was that apiece?

5. A grocer bought cheese at 48¢ a pound and sold it at 56¢. What was his per cent of gain on 500 pounds?

6. A football suit sells at wholesale for \$7.50. This amount is 75 per cent of the retail price. The retail price is what per cent of the wholesale price?

7. How many pairs of shoes at $9\frac{3}{4}$ can be bought for \$117? Can you solve without pencil?

8. Mr. Boswick sold his house for \$3900, thereby gaining $8\frac{1}{3}$ per cent over the cost price. How much did he gain? Can you solve without pencil?

9. I spent $37\frac{1}{2}\%$ of my money for a watch costing \$72. How much money had I left?

10. Potatoes boiled with the skins on lose .2% starch; those that are pared and then boiled lose 2.7%. Find difference in total quantity of starch lost by cooking 3 potatoes weighing $6\frac{1}{2}$ ounces.

11. The difference between two numbers is 27, and the greater is four times the lesser. Find the numbers. Algebra.

12. A flywheel 4 inches in diameter makes 120 revolutions a minute. How far does a point on its outer circumference move in that time?

89.* *The Value of Quality.*

Make three original problems suggested by the information given below.

I. Wood from One Tree under Increasing Skill.	Cord wood worth $3 to $7. One day's work. Lumber worth $20. Three or four days' work. Lumber quarter-sawed worth $40. Ten or twelve days' work. Furniture worth $500. One year's work. A Cremona violin worth thousands of dollars upon which the Italian woodcarver could spend his whole life.

II. Iron under Heat and Pressure.	Pig iron worth $\frac{3}{4}$¢ a pound. Railroad iron capable of sustaining the weight of transcontinental trains worth $1\frac{1}{2}$¢ a pound. Spring iron capable of breaking the shock of a big automobile, worth $4\frac{1}{2}$¢ a pound. Cutlery iron from which are made razors, penknives, etc., worth 7¢ to 10¢ a pound. Tool iron worth 90¢ to $1.50 a pound. Main spring of a watch worth $87.40 a pound. Hair spring of a watch worth $1,050 a pound.

III. Advantage of Staying in School until 18.

The Weekly Wages of Boys Leaving School

At 14, the End of Grammar School	Age	At 18, the End of High School
$9.00	14	In School
12.00	16	In School
16.00	18	$27.00
21.50	20	37.50
24.00	22	48.00
27.00	24	60.00
31.00	25	75.00
$14,664 Total earnings at end of 25th year		$25,740

The increased annual income at the end of the 25th year, due to the value of the 4 years in high school equals ($75.00 − $31.00) × 52 (weeks in year) = $2288.

This is equivalent to an investment of $45,760 at 5 %. Can a person permanently increase his capital as well or as fast in any other way?

90. *Written Problems.*

1. Mr. E. C. Davis owns a house valued at $6400. He rents it for $780. What is his net rate of income if he pays $93.40 for taxes, $24.20 for insurance and $144 for other expenses?

2.† I marked some goods at 40% above cost, sold them at 25% less than the marked price, and gained $370. What was the cost of the goods?

3. Albert Meier has a claim of $8000 against a corporation. He pays the collector 5% of the amount collected. What is his total loss, including the collector's fee if but 65% of the claim is collected?

4. F. H. Herron bought 900 tons of coal at $8 per ton and sold it at a gain of 25%. Find his net profit if he lost 3% in bad debts and paid $120 for freight, delivery, etc.

5. At $32 per ton, find the cost of fertilizer for 250 young peach trees, allowing $1\frac{1}{4}$ lb. per tree.

6. If .125 of an acre is worth $15, how much are 25 acres worth?

7. A baseball team won 30 games and lost 50 during the season. What per cent of the games played did the team win?

8. The Empire State Express left Buffalo at 1 P.M. and arrived in Albany at 6:57 P.M. The distance is 297.5 miles. What was the average number of miles per hour made by the train?

9. Charles Jones bought an automobile of George N. Johnson and Company for $4000. He paid $2500 in cash and for the balance gave a promissory note for 3 months, with interest at 5%. Write the note dating it January 15, 1919.

10. A street half a mile long and 60 feet wide is paved with granite blocks. If 30 blocks are required to pave one square yard, how many will be required to pave the whole street?

11. Find the interest on $450 for 1 yr. 3 mo. 20 days at 6%. Banker's method.

† See Table of Contents.

12. A man sold 48 shares of $3\frac{1}{2}\%$ stock at 86 and loaned the proceeds at 5%. How much did he increase his annual income?

13. I sold a consignment of 4000 barrels of flour at $12 a barrel. I paid $73 for storage and $54 for cartage. How much should I remit after deducting a commission of $\frac{1}{2}\%$?

14. F. P. Hawley desired to grind together oats and barley at the ratio of 3 bushels of oats to 2 bushels of barley. He had 32 bushels of barley. What quantity of oats was required? Solve by proportion.

15. I received $720 interest on a certain sum of money at 6% for a year and a half. What was the principal? Solve in as many ways as you can.

16. Three men are charged $72 freight on a shipment of potatoes. If the first man shipped 300 bushels, the second man 400 bushels, and the third man 500 bushels, how much should each pay?

17. An oriental rug which cost $85 at the loom, $5 for shipping and 50% custom duty was sold for $200. What was the per cent of gain?

18. A varnish works bought an automatic sprinkling system. It saved the firm $4800 a year insurance which was a saving of $66\frac{2}{3}\%$ on what the company formerly paid. What insurance do they pay now? Work in as many ways as you can.

19. A famous pianist insured each of his fingers for $2000 at the rate of $\frac{3}{4}\%$. How much premium did he pay? Make an original problem showing the circumstances under which he might claim all or part of the insurance.

20. A can do a piece of work in 6 days; B can do it in 8 days. If B's wages are $4.80 per day, how much should A receive per day?

21. A bicycle wheel is 35 inches in diameter. How many times will the wheels turn in going 30 rods?

22. Write a promissory note for $900 dated January 1, 1919, payable without interest to A. C. Bicknell 3 months after date.

23. An American merchant in Rio de Janeiro invested $10,000 in a coffee plantation. If 1 milreis is equivalent to $.54¾, how much did he spend in the money of the country?

24. A fruit grower ships prunes in 90 boxes 4 feet long, 2 feet broad and 2 feet deep. If the same quantity is shipped in boxes of the same breadth and depth and half the length, how many will it take?

25. What time is it now on the meridian which is 90 degrees west of your city?

26. A square lot has an area of 6889 sq. ft. How many feet long is one side?

27. A dealer buys 320 yds. of cloth at 87½¢ a yard. At what price per yard must he sell it to make a profit of $40?

28. The foot of a ladder which is placed 27 feet from the base of a building reaches a window 36 feet from the ground. What is the length of the ladder?

29. How many cubic feet of water would fill a manhole 4 feet in diameter and 8 feet in depth (cylinder)?

30. If ice shrinks 32% from the time it is harvested until it is sold, how many tons of ice must be put up in the winter in order to sell 6800 tons?

31. The roof of a state house is in the form of a hemisphere 80 feet in diameter. How many square yards of paint will be required for it?

32. In 12 quarts of jelly there were 2 quarts more of fruit juice than of sugar; how many pints of fruit juice were there in the whole amount? Algebra.

33. A city whose population was 80,000 had 5000 children of school age; the total population increased to 96,000 and the number of children of school age increased proportionally. How many children were there then?

34. If a sum of money earns $96 interest in 5 years, how much will it earn in 16 years at the same rate per cent?

35. Mr. E. F. Hines bought a Liberty Bond issued by the federal government in June, 1917, for which he paid $750. What was his annual income at $3\frac{1}{2}\%$?

36. Two men engage in business with a joint capital of $5000. The first year's gain was $1760, of which one received $1056. How much capital did each furnish?

37. Mr. Abbott earns $2500 a year. $1000 of this sum is a guaranteed salary. The remainder is his commission of 5% on his sales. What is the annual amount of his sales?

38. I purchased stock at a premium of 8%. What rate of interest do I receive on the investment if it pays an annual dividend of 6%?

39.† Find the difference in time between San Francisco which is 122° 26' 15'' west longitude and Philadelphia, which is 75° 10' 0''.

40. A school board issued bonds to pay for a new high school building. The annual interest on these bonds at $4\frac{1}{2}\%$ was $1800. What was the amount of the bonds issued?

41. How much more fence is required for a field 90 rods by 40 rods than a square field of equal area?

42. A tank measuring 24 ft. × 8 ft. × 10 ft. is half full of water. What is the weight of the water in tons? A cubic foot of water weighs $62\frac{1}{2}$ pounds.

43. I gave $6\frac{2}{3}$ pounds of butter worth 60¢ a pound for $5\frac{1}{3}$ gallons of oil. What was the cost of the oil per gallon? Cancellation.

44. John sells 16 more papers than Henry and together they sell 40 papers. How many papers does each sell?

45. A man owns real estate assessed at $6150 and personal property assessed at $1350. The rate of taxation is $2.14 on the $100 with a poll tax of $2. What is the amount of his taxes?

† See Table of Contents.

46. Compute the cost of fencing a field 46 rods 11 feet long and 32 rods wide at $3.60 per rod.

47. A 60-day note for $4500 dated December 10, 1916, with interest at 5%, was discounted January 1, 1917, at 6%. Find the discount.

48. My agent in Baltimore having sold a consignment of grain, after taking out his commission of 2% and paying a freight bill of $2125, sent me a draft for $19,533. For how much was the grain sold?

49. An entertainment for the benefit of the Red Cross was held in a school auditorium containing 900 seats; $\frac{1}{2}$ of the seats were sold for $1 each; $\frac{1}{6}$ for 75 cents each and $\frac{1}{3}$ for 50 cents each. How many sweater outfits at $15 each could be purchased with the proceeds?

50. A reservoir 3 feet 8 inches long, 1 foot 9 inches wide, 1 foot 3 inches deep has 9 inches of water in it. How many gallons of water in it? There are 231 cubic inches of water in a gallon.

51. A farmer had a rectangular field which was twice as long as it was wide and contained 20 acres. He divided it into two square fields and fenced them at 14 cents per foot. How much did it cost him?

52. Find the cost of the following at $15\frac{1}{2}$¢ per board foot:
2 pieces $\frac{7}{8}'' \times 6'' \times 16'$
1 piece $2'' \times 8'' \times 24'$

53. Complete the following equations if $a = 2$, $b = 3$.
(1) $17 - ab = 5a + ?$
(2) $12 + ab - ?a = 2b$.

54. Mr. W. H. Brydon bought a shipment of bricks for $222 at $14.80 a thousand. How many bricks did he buy?

55. The ratio of the length of a building to its height is 4.3. The length is 120 feet. How tall is the building?

Test Page I

This page and the one following contain types of exercises which can be used for testing the work of Part II, Section Two. A class percentage of not less than eighty should be required.

I

Write answers only:

1. Write $2\frac{1}{2}\%$ as a decimal and as a common fraction.

2. How many feet are there in 50% of a mile?

3. If 42 be added to a certain number, the result is 4 times that number. Find that number.

4. What is the interest on $200 at 6% for 1 year 2 months?

5. If $\frac{2}{3}$ of a yard of silk cost $3, how many yards can be bought for $21?

II

Show all work — time limit 25 minutes:

1. Two friends agree to share the expenses of an outing trip in the ratio of 3:5. The expenses are $240. What ought each to pay?

2. What is the area of a triangular strip of ground lying between a railroad track and a wagon road with dimensions as given in the diagram?

90 rd.

18 rd.
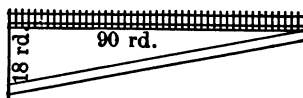
3. I bought 5% bonds at 80. What rate per cent of interest did the investment yield?

4. How much does it cost annually to insure the *Oregon* for $1,725,000 if $2\frac{1}{4}\%$ is paid for the insurance?

5. At what price must I mark goods that cost $4 per yard in order that I may deduct 20% and still make 20%?

Test Page II

III

Oral Problems

Before solving, name the operation to be used.

1. $36,000 insurance at $\frac{3}{4}$% gives what premium?

2. If A can roof a house in 3 days, B in 4 days, how long will it take if both work together?

3. A family uses $\frac{4}{5}$ of a barrel of flour in a month. How long will $\frac{2}{3}$ of a barrel last them?

4. Which is better for the customer, continued discount of 10% and 5% or 15% off?

5. The margin of a printed page is $\frac{1}{4}$ of its surface. The printed surface is 4 inches by 6 inches. How many square inches in the page?

IV

Write at dictation:

1. Add: $3.46 + 95.679 + 7.876 + 58.73 + 968.6 + 794.68$
(two minutes).

2. Find the difference between: 4004.003 and 2976.00976
(two minutes).

3. Multiply 5789 by $426\frac{5}{8}$ (three minutes).

4. Divide 460,765.3 by .569 (three minutes).

5. Find the value of: $\dfrac{3.8 \times .40 \times 5.5}{.44 \times 1.9 \times 50}$ (two minutes).

V

Each child one exercise (oral):

1. $.3 \times .04 = ?$
7 is 14% of ?
$14.3 - .6 = ?$
24 is what % of 36?

2. $468 \div 7 = ?$
7% of 14 is ?
$.02 \times 6 = ?$
36 is what % of 24?

3. $.6 - .03 = ?$
14 is 7% of ?
$724 \div 3 = ?$
36 is what % of 24?

4. $56 \div .7 = ?$
18 is 9 % of ?
18 is what % of 27?
27 is what % of 18?

SUGGESTIONS TO TEACHERS

1. Read the Preface and the Table of Contents.

2. Make haste slowly. See that each day's lesson averages about 80 % perfect for class work. Note weaknesses, explain and follow with similar work the next day.

3. Introduce new ideas inductively and through situations that are vitally interesting to the child. This can best be done by a generous use of dramatization. In dramatization throw the burden of suggestion upon the pupils. The ingenuity fostered when children transform schoolroom furniture or construct at home playthings for school use is of inestimable value to them. Moreover, the lesson thought out by twenty-five minds is far richer in suggestive material than one which only the teacher plans. Insist on play *for the sake of number* — not for mere amusement. Require the utmost courtesy at all times.

4. Follow concrete and objective presentation with systematic flash practice with the number symbols. Use large perception cards for this purpose. *Keep up this practice for short periods daily until the reaction is automatic. Then stop,* and go on to more difficult exercises. Do not go to the miscellaneous practice until the child knows his number tables in order, forward and backward. No concert work.

5. Lastly, apply the idea to new concrete situations.

Insist upon the strictest honesty in the preparation of papers. Class spirit will do more to check cheating than any device.

6. Encourage free, graphic illustration of concrete problems.

7. Teach the child to estimate answers before beginning to figure, and to use his common sense on all occasions. Give frequent exercises in which the pupils do nothing but estimate answers in round numbers, or in which they merely indicate the process by which the answer is to be obtained.

8. Put a premium on the original solution of a problem. Commend highly the child who has ingenuity enough to see two or more correct methods.

9. Periodically call for original problems from the class. When presented, have the pupils criticize them for interest, for probability, for test of thinking power, etc. Use the best problems.

10. Endeavor so to stimulate the class that each pupil will strive to work out for himself the special study lessons marked *. These are so carefully graded that the pupil with average ability will have no difficulty.

11. Give quantities of oral work from the book. The pupils should learn that the result may be arrived at in different ways, and that while they wait for the slower members of the class to get the answer they have time to check.

12. Require pupils to check answers until they have acquired the habit.

13. Make accuracy the first requisite and speed the second.

14 Encourage each pupil to keep a record of his individual progress.

15. Teach pupils to help one another without telling the answer. Pupil teaching is in many ways the most vital of all.

16. Follow the order of the text-book and supplement it by exercises fitted to the needs of individual classes, no two of which are ever exactly alike.

17. Make success the keynote of the work.

How One Recitation Might Be Conducted

Grade: Advanced Seventh.   Time: 30 minutes.

Part I — 5 Minutes

From the book and without pencil, Exercises 71 and 73, page 117, or on paper, at teacher's dictation, an adaptation of Exercise 57, page 106.

PART II — 10 MINUTES

Study of arithmetic papers prepared alone by the pupils on the previous day. These papers have been graded by the teacher, who has made note of individual failures. The pupils now see their papers for the first time. Lesson assigned: problems 3–4–5 on page 107 and Exercise 69 (1 and 2) on page 116.

The teacher announces that the class made 80 per cent on the papers, just the standard she is trying to maintain.

Those pupils who have failed on the first problem should be asked to rise for help. The failures are of two kinds: (1) those who failed to visualize the social background (they are asked to dramatize); and (2) those who failed to recognize Case III. (These are asked to make a similar problem with smaller numbers, such as "$16 (instead of $168) is what part of $80 (instead of $8400)?" Commend pupils who took the shorter method of solution.)

Those who failed on the second problem probably failed to recognize Case II. Call for diagram and logical analysis. Mistakes in computation are less serious.

Those who failed on the third problem probably failed on form of bill, which should be reviewed.

Those who failed on the abstract examples should be sent to the board and given new exercises until the teacher is satisfied that they understand. The rest of the class, at their seats, should figure with them for practice.

PART III — 15 MINUTES

Bank Discount, Exercise 74, on page 118.

On the previous day the teacher has told the pupils that they may come prepared to dramatize and to explain what they have studied out alone.

The written lesson assigned for the next day is problem 2, page 120, together with problems 6 and 7, page 107, and Exercise 69 (3), page 116. Time, 30 minutes.

TABLES

Linear Measure

12 inches (in.)........	=1 foot...........	(ft.)
3 feet	=1 yard...........	(yd.)
5½ yards, or 16½ feet ..	=1 rod...........	(rd.)
40 ~~rods~~	=1 ~~furlong~~	(fur.)
320 rods, or 5280 feet ..	=1 mile	(mi.)

1 mi. = 320 rd. = 1760 yd. = 5280 ft. = 63,360 in.

Surveyors' Linear Measure

7.92 inches (in.).....	=1 link...........	(l.)
25 links...........	=1 rod...........	(rd.)
100 links...........	=1 chain........	(ch.)
80 chains	=1 mile.........	(mi.)

Square Measure

144 square in. (sq.in.) ..	=1 square foot	(sq.ft.)
9 square feet (sq.ft.) .	=1 square yard	(sq.yd)
30¼ sq.yd., or 272¼ sq.ft.	=1 square rod.	(sq.rd.)
160 square rods........	=1 acre...........	(A.)
640 acres..............	=1 square mile	(sq.mi.)

1 A. = 160 sq.rd. = 4840 sq.yd. = ~~43,560~~ sq.ft.

Cubic Measure

1728 cubic inches (cu.in.)	=1 cubic foot ..	(cu.ft.)
27 cubic feet..........	=1 cubic yard.	(cu.yd.)
128 cubic ft.	=1 cord..........	(cd.)
16 cubic feet	=1 cord foot....	(cd.ft.)
8 cord feet	=1 cord cord ..	(cd.)

Measure of Time

60 seconds (sec.)......	=1 minute......	(min.)
60 minutes	=1 hour..........	(hr.)
24 hours..............	=1 day..........	(da.)
7 days	=1 week	(wk.)
365 days	=1 ~~common~~ year.	(yr.)
366 days	=1 leap year	

Dry Measure

2 pints ....=1 quart............(qt.)
8 quarts..............=1 peck ....(pk.)
4 pecks ....=1 bushel ....(bu.)

Liquid Measure

4 gills ....=1 pint............(pt.)
2 pints .... /......=1 quart ....(qt.)
4 quarts ....=1 gallon ....(gal.)
31½ gallons .... =1 barrel............(bbl.)
63 gallons.............=1 hogshead ......(hhd.)

Avoirdupois Weight

16 ounces (oz.) ....=1 pound ....(lb)
100 pounds ....=1 hundredweight (cwt.)
2000 pounds.............=1 ton..............(T.)
   One pound Avoirdupois = 7000 grains

Troy Weight

24 grains (gr.) ....=1 pennyweight...(pwt.)
20 pennyweights.......=1 ounce............(oz.)
12 ounces ....=1 pound...........(lb.)
   One Pound Troy = 5760 grains

Apothecaries' Weight

60 grains (gr.) ....=1 dram ....(dr. or ʒ)
8 drams.............=1 ounce...... (oz. or ℥)
12 ounces ....=1 pound......(lb. or ℔)
   One Pound Apothecaries' weight = 5760 grains

Apothecaries' Liquid Measure

60 minims (m.)........=1 fluid dram........(ʒ)
8 fluid drams.........=1 fluid ounce ....(℥)
16 fluid ounces........=1 pint .....(fl. oz. or ○)
8 pints...............=1 gallon ....(cong.)

PAPER

25 sheets = 1 quire
20 quires = 1 ream

Money

UNITED STATES AND CANADA	BRITISH ISLES
10 mills = 1 cent (¢)	4 farthings (far.) = 1 penny (d.)
10 cents = 1 dime	12 pence = 1 shilling (s.)
10 dimes = 1 dollar ($)	20 shillings = 1 pound sterling (£)

GERMANY	FRANCE
100 pfennig (pf.) = 1 mark (M.)	100 centimes (c.) = 1 franc (fr.)

VALUE OF FOREIGN COINS IN UNITED STATES MONEY BEFORE
WORLD WAR

COUNTRY	COIN	VALUE IN U. S. MONEY	COUNTRY	COIN	VALUE IN U. S. MONEY
Argent. R.	Peso	$0.965	India	Rupee	$0.324
Austria-H.	Crown	.203	Italy	Lira	.193
Belgium	Franc	.193	Japan	Yen	.498
Bolivia	Boliviano	.389	Mexico	Peso	.498
Brazil	Milreis	.546			
Canada	Dollar	1.00	Netherlands	Florin	.402
Cent. Am.	Peso	.435	Newfoundl'd	Collar	1.014
Chile	Peso	.365	Norway	Crown	.268
China	Tael — Shanghai	.651	Panama	Balboa	1.00
	Tael — Haikwan	.726	Peru	Libra	4.866½
	Tael — Canton	.711	Portugal	Milreis	1.08
Colombia	Dollar	1.00			
Costa Rica	Colon	.465	Russia	Ruble	.515
Denmark	Crown	.268	Spain	Peseta	.193
			Sweden	Crown	.268
Ecuador	Sucre	.487	Switzerland	France	.193
Egypt	Pound (100 piasters)	4.943	Turkey	Piaster	.044
France	Franc	.193	Uruguay	Peso	1.034
Germany	Mark	.238			
Gt. Britain	Pound sterling	4.866½	Venezuela	Bolivar	.193
Greece	Drachma	.193			
Hayti	Gourde	.965			

METRIC SYSTEM

LENGTH

10 millimeters (mm.) = 1 centimeter (cm.)
10 centimeters = 1 decimeter (dm.)
10 decimeters = 1 meter (m.)
10 meters = 1 dekameter (Dm.)
10 dekameters = 1 hektometer (Hm.)
10 hektometers = 1 kilometer (Km.)
10 kilometers = 1 myriameter (Mm.)

SURFACE

100 square millimeters (sq. mm.) = 1 square centimeter (sq. cm.)
100 square centimeters = 1 square decimeter (sq. dm.)
100 square decimeters = 1 square meter (sq. m.)
100 square meters = 1 square dekameter (sq. Dm.)
100 square dekameters = 1 square hektometer (sq. Hm.)
100 square hektometers = 1 square kilometer (sq. Km.)

LAND

100 square decimeters = 1 centare (ca.)
100 centares = 1 are (a.)
100 ares = 1 hektare (Ha.)

VOLUME

1000 cubic millimeters (cu. mm.) = 1 cubic centimeter (cu. cm.)
1000 cubic centimeters = 1 cubic decimeter (cu. dm.)
1000 cubic decimeters = 1 cubic meter (cu. m.)

WOOD

10 decisteres (ds.) = 1 stere
10 steres = 1 dekastere

CAPACITY

10 milliters (ml.) = 1 centiliter (cl.)
10 centiliters = 1 deciliter (dl.)
10 deciliters = 1 liter (l.)
10 liters = 1 dekaliter (Dl.)
10 dekaliters = 1 hektoliter (Hl.)
10 hektoliters = 1 kiloliter (Kl.)

WEIGHT

10 milligrams (mg.) = 1 centigram (cg.)
10 centigrams = 1 decigram (dg.)
10 decigrams = 1 gram (g.)
10 grams = 1 dekagram (Dg.)
10 dekagrams = 1 hektogram (Hg.)
10 hektograms = 1 kilogram (Kg.)
10 kilograms = 1 myriagram (Mg.)
10 myriagrams = 1 quintal (Q.)
10 quintals = 1 metric ton (M. T.)

EQUIVALENTS OF METRIC MEASURES

METRIC   **METRIC**

1 liter = 1 cu. dm.
1 gram = weight of 1 cu. cm. of water.
1 are = 1 sq. Dm.
1 stere = 1 cu. m.

METRIC ENGLISH	ENGLISH METRIC
1 m. = 39.37 in.	1 yd. = .9144 m.
1 Km. = .62137 mi.	1 mi. = 1.60935 Km.
1 sq. m. = 1.196 sq. yd.	1 sq. yd. = .836 sq. m.
1 Ha. = 2.471 A.	1 A. = .4047 Ha.
1 cu. m. = 1.308 cu. yd	1 cu. yd. = .765 cu. m.
1 l. = { .908 qt. (dry) / 1.0567 qt. (liq.)	1 qt. (dry) = 1.1012 l. / 1 qt. (liq.) = .94636 l.
1 Hl. = 2.8377 bu.	1 bu. = .35239 Hl.
1 Kg. = 2.2046 lb.	1 lb. (av.) = .45359 Kg.
1 M.T. = 1.1023 T.	1 T. = .90718 M. T.

ANGLES AND ARCS

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circumference

A right angle = 90°.   An acute angle is less than 90°.
                             An obtuse angle is greater than 90°.

COUNTING

12 units = 1 dozen (doz.)
12 dozen = 1 gross
12 gross = 1 great gross

A score is 20 things.

$\frac{1}{3} = 33\frac{1}{3}\%$

$\frac{2}{3} = 66\frac{2}{3}\%$

$\frac{1}{6} = 16\frac{2}{3}\%$

$\frac{5}{6} = 83\frac{1}{3}\%$

$\frac{1}{8} = 12\frac{1}{2}\%$

$\frac{3}{8} = 37\frac{1}{2}\%$

$\frac{5}{8} = 62\frac{1}{2}\%$

$\frac{7}{8} = 87\frac{1}{2}\%$

$\frac{1}{7} = 14\frac{2}{7}\%$

$\frac{1}{9} = 11\frac{1}{9}\%$

$\frac{1}{11} = 9\frac{1}{11}\%$

$\frac{6}{7} = 85\frac{5}{7}\%$

$\frac{1}{12} = 8\frac{1}{4}\%$

$\frac{11}{12} = 91\frac{3}{4}\%$

30 Days = 1 mo

Carry to 3d place if not even.

Premium = Percentage

" of Policy = Base

of insurance = Rate

Equivalents

$$I \frac{1}{10} = 10\%$$

$$\frac{3}{4} = 7$$